Policy and Research Paper N°3

Health and Mortality Trends among Elderly Populations Determinants and Implications

Walter Mertens

ISBN 2-87108-034-8

Introduction

Policy & Research Papers are primarily directed to policy makers at all levels. They should also be of interest to the educated public and to the academic community. The policy monographs give, in simple non-technical language, a synthetic overview of the main policy implications identified by the Committees and Working Groups. The contents are therefore strictly based on the papers and discussions of these seminars. For ease of reading no specific references to individual papers is given in the text. However the programme of the seminar and a listing of all the papers presented is given at the end of the monograph.

This policy monograph is based on the Conference on 'Health and Mortality Trends among Elderly Populations: Determinants and Implications' organized by the IUSSP Scientific Committee on Adult Mortality and the City of Sendai, held at the Japan Aging Research Center of Sendai from 21 to 25 June 1993

The monograph starts with a short overview of the remarkable decline in mortality at the older ages which recently occurred in the low mortality countries. It then proceeds to discuss three issues surrounding this unexpected trend which have important policy implications: 1) adequacy of data, concepts and methodologies to fully understand this trend; 2) the future course of mortality for the elderly; and 3) the prospects for the quality of life of the elderly. The monograph ends with an effort to distil a series of policy conclusions.

An Unexpected Trend in an Unprecedented Transition

Until very recently it was the conventional wisdom among demographers in low mortality countries that little scope was left for further decreases in mortality and increases in life expectancy at the older ages. Indeed, a common characteristic of all national forecasts until recently was that after a certain period of time the pace of increase in life expectancy would decrease and that eventually life expectancy would flatten out. As a consequence, the future population in more advanced age groups was seriously underestimated in all countries at the upper end of the life expectancy scale. In all population projections the proportion of the older population was underestimated. While for ages around 60 forecast errors were small, percentage errors for the group 85 years and over were larger than for all other ages. In developed countries persons over 85 years of age are now the most rapidly growing group. The dying process in the low mortality countries is increasingly becoming an old age experience. Except for Eastern Europe and the former Soviet Union, over three quarters of men and close to 90 percent of women can now expect to reach the age of 65 in developed countries.

Demographers have correctly predicted the growing importance of ageing in countries which had completed their demographic transition. Their prediction was based on 'ageing at the bottom ' of the age pyramid, consequence of the massive declines of fertility which had taken place in these countries. However, they did not predict that 'ageing at the top ' could become so important. In the past few years demographers legitimately emphasized that the popular press and some social science literature overplayed the importance of mortality decline as the cause of the increase of the older population due to confusion about the impact of fertility decline on the age structure. Recently, however, a more balanced view has come into play. Mortality changes in industrialized countries are less smooth and gradual than expected. The traditional assumption that mortality was the least problematic of the components of population change had to be abandoned. While it is true that mortality cannot come close to the cumulative effect of fertility on the age distribution, in the low mortality countries the most important factor in the 'short run ' determining the future age structure of the population is the spectacular decline in the mortality of the elderly.

Historically, while only a small but robust subgroup of the human population was able to survive into older ages, survival into older ages has now become commonplace in developed nations. This dramatic transition only occurred in the last 100 years. The major demographic effects of this epochal transition have been explosive growth and population ageing. The 'epidemiological ' or 'health ' transition, part of the demographic transition which also includes the secular decline in fertility, is now a commonly accepted name for these changes in

mortality. It has been characterized by transitions in overall mortality, from high to low infant mortality, communicable to non-communicable diseases and normally, at least until recently, increasing advantage of females over males.

Closely connected with and a consequence of the demographic and epidemiologic transitions is the age transition or the 'secular shift in ageing ', as it has been called by Laslett, a British demographer. The secular shift in ageing is the consequence of an extremely rapid rise from a plateau of fairly stable low figures for longevity and proportions of the population in late life which characterized every population in the limitless historical era preceding the demographic transition. From that plateau the secular shift in ageing brought populations up to the higher plateau of very pronounced longevity and very large proportions of those in the populations of late life.

Recent changes in the mortality of the older people together with the appearance of new and old contagious diseases has made some demographers speak of a fourth phase of the epidemiological transition which would have the following features:

1. Continuation of slow and often fluctuating mortality declines which are increasingly concentrated at the later stages of life

2. Stability and even some signs of some reversal in mortality differential between men and women

3. Variable patterns of change of underlying causes of death including the major chronic diseases

4. Emergence of certain communicable diseases as important causes of death as well as variation in external causes of death.

Table 1 summarizes information on life expectancy at age 65 for the low mortality countries. In the first row Table 1 gives years of life which can normally be expected after 65 by males and females in low mortality countries. The third column gives the additional years life expectancy of females over males. The second and third rows give the highest and lowest figures for life expectancy after age 65 and mentions the countries and years in which these figures were obtained, while the third column of these rows points to the figures and countries in which the discrepancy for males and females were the greatest and the least. It must be noted that different methods of calculating life expectancy might be used resulting in slightly different values and thus, perhaps, different countries in the highest and lowest categories. Nevertheless, this table gives an accurate indication of current 'normal ' and extreme figures for life expectancy at age 65 in low mortality countries.

Table 1: Life Expectancy at Age 65 in Low Mortality Countries CA 1990

	Life expectancy for males	*Life expectancy for females at age 65*	*Difference in male/female life expectancy at age 65*
Normally above (ca 1990)	*12 years*	*15 years*	*3 years*
Highest Figure	*16.4 (Japan 1990)*	*20.6 (France 1990)*	*4.7 (Netherlands 1990)*
Lowest figure	*11.9 (Czecho-Slovakia 1990)*	*15.2 (Romania 1989)*	*1.8 (Israel 1989)*

As the level of mortality changed for the elderly there were major shifts in the cause specific structure of death at advanced ages both in terms of the age distribution of deaths at later ages and the importance of select conditions as underlying versus associated causes of death. In general it seems that circulatory diseases declined as factors in mortality at late ages. Declines in mortality due to cardiovascular disease was a most important factor in the decline in mortality of the elderly. The decline in cardiovascular disease, however, has not occurred uniformly in all industrialized societies because in some countries smoking, alcohol and fat consumption remain

high in middle age and elderly populations. In other countries the risk of cardiovascular diseases is low because of nutritional factors (see Box 6 on Japan). Generally, mortality from cancer also seems to be on the decline.

On the other hand, certain diseases have become more important as causes of mortality. In the USA, for example, the diseases which increased in importance as underlying causes of death in major age categories were septicaemia, cancer, pneumonia, chronic lung disease and nephritis/nephrosis. An unfavourable trend for women is breast cancer. Another example of shift in causality is the recent history of cancer of the digestive tract which, until the mid-1980's, was the most frequent cancer world-wide. At that time it began to decline everywhere and was supplanted by lung cancer.

These remarkable changes create crucial policy challenges on several fronts. Two areas stand out. One is the social security system because mortality usually has more effect on social security deficits than do variations in fertility, migration, real interest rates, the rate of inflation or disability rates. The other is the increasing social and health needs of the elderly, who are increasing both in absolute and relative numbers. These issues will add to the financial burden and conflicts of governments already facing needs of other age groups and having to deal with new health and social problems such as illegal migration and AIDS.

Box 3: The Increase in Centenarians

Centenarians are now the fastest growing age group in many industrialized countries. Some caution is always required for the correct estimation of the number of centenarians. Although prestige of old age declines in many countries, it normally increases around 100, hence the tendency to overestimate age as one nears 100 years. However there is no doubt that remarkable declines of mortality above 100 years of age have occurred during the last decades. It is now common to use a closing age of 100 to 110 years in current life tables compared with 80 years as used by Graunt in 1662. In France there were approximately 200 centenarians in 1954. In 1990 there were more than 3,000. In 1954 there were about 5,000 persons of age 95 and over and about 53,000 of age 90 and over. For 1993 the respective figures are 46,000 and 299,000. A substantial proportion of these will celebrate their 100th birthday. Some researchers have concluded that people over age 95 may be healthier than the population dying at earlier ages because of the latter's higher vulnerability to even one source of significant disease.

Rather than concentrating on these two broad fronts this policy monograph will focus on some of the more fundamental questions deserving priority attention from policy researchers and policy makers. Only when those issues are clarified can satisfactory treatment be given to the derivative problems mentioned in the previous paragraph. The issues are the following:

- Do we have adequate data, concepts and methodologies to understand these new developments?

- What will be the future course of mortality for the elderly in the low mortality countries?

- Is the increased length of life accompanied by sufficiency of quality of life of the elderly?

Even though it occurred in countries with good population data, the rapid increase in the older population has shown that many shortcomings exist in regard to conceptual issues, availability of data, and appropriate methodologies for obtaining an adequate picture of the elderly. Future improvements will depend more on the political will to use internationally standardized concepts and methods of study than on the solution of technical difficulties.

Three questions especially merit detailed consideration for better conceptualization, for better data collection and for better analysis. First, how do we identify the elderly? Second, how do we measure the quality of life of the elderly? Third, how do we determine cause of death of the oldest age groups?

How do we identify the elderly?

There is still no agreement on the age at which a person becomes old. Demographers traditionally use a particular age as the beginning of old age, assuming that calendar age and biological age are synonymous. This age, often set at age 65, varies from country to country and from time to time reflecting cultural and social class differences and other criteria related to the degree of biological decline. The definition of certain age groups as separate sociological categories is, in fact, a social construction and often reveals patterns of established political and economic power. The lower retirement age often set for women is an example of a view of women as weak

beings who need special protection. The assumed symmetry between calendar age and biological theories in the past gave rise to misconceived biological transitions such as the 'grand climacteric ' which was once thought to occur between ages 45 and 55 for women and between 55 and 75 for men.

The use of one particular age to denote old age as an ascriptive status has become anachronistic in the contemporary world. The attributes which did, in fact, characterize a high proportion of the relatively small group who survived to old age can no longer be used to characterize the current older population. This change vividly demonstrates that the elderly cannot simply and homogeneously be defined as the group of persons above a certain age. More and more countries realize the importance of having detailed data on the elderly. Thus the propriety of using open age groups, especially at relatively lower old ages, has come under sharp criticism. The relatively low open interval used in the past not only reflected the smaller size of the group but also the poor quality of data, especially misreporting at advanced ages. Few European countries are still satisfied with a closing interval of 75 and over. Most now use 85 and over as the closing age group. More people die after age 80 and more precise measures of old age mortality are required. More detailed age groups for the elderly will allow much better characterization of their age patterns of mortality, preparing the way for more appropriate programmes and policies.

Until recently, except among gerontologists, very little differentiation in older age categories was made. Most people concerned with the study and the problems of the elderly now feel that in order to transcend the view of complete homogeneity of later life, as a minimum, descriptions of the elderly should be separated into the third age (the young old) and the fourth age of final dependency (the old old). The concept of third age is a novelty which is only viable in the relatively well-to-do and very long-lived populations which emerged in the mid-twentieth century.

How do we measure the quality of life of the elderly?

With the growing importance of the elderly population has come realization that the concepts of life span and of life expectancy must be better defined. The figure used for the maximum span of human life, which is usually defined as the maximum biologically possible duration of life, changed from around 85 years in the early 1700's to the current figure of around 120. As more people survive to old age and as the survival curve thus becomes more rectangular, the less meaningful as an indicator of mortality change becomes the notion of life expectancy (the number of additional years a person can expect to live if current mortality patterns prevail).

Furthermore, the notion of life expectancy does not give expression to the quality of life of the elderly population. This has called into existence the concept of 'health expectancy' or 'disability-free life expectancy'. This idea, then, directed attention to the definition of disability and related concepts such as handicap, injury, impairment and morbidity and to the need to have internationally accepted definitions for comparative purposes. For example, three studies using the concept of disability-free life expectancy from Quebec, Australia and the USA produced very different results. Simultaneously there was a decrease in disability-free life expectancy in Australia, a stagnation in the USA and a gain in Quebec. Such contradictory results must be the consequences of different criteria used in the definitions and perceptions of disability and handicaps, which, as experience has shown, can change through time. Crude disability rates in current statistics have been found to vary from 3 to 15 percent for the older population. Regional comparisons may, therefore, be misleading as is the case of higher disability rates which often are found in the comparison of European with Asian and African countries. These are the consequence of the more encompassing notions of disability which are used in European statistics.

There is really no accepted umbrella term to describe impairments, disabilities and handicaps and hence the high degree of variability in disability statistics. The lack of standardization is partially the consequence of demographers without formal training in disability having been responsible for instructions and disability questions in surveys and censuses. Often the use of ill defined categories such as senility complicates the problem. Professional descriptions of severity of mental impairments have often been translated by censuses into very pejorative lay terms such as imbecile, idiot, moron and others.

The measurement of disability therefore is problematic. Should we rely on objective criteria or on self-assessment? When using the presence of clinically diagnosed diseases, usually a minority of 75 to 80 year olds are found to be healthy. On the other hand about a half of the same group regard themselves as healthy. The discrepancies come from adaptation to certain symptoms which are accepted as normal consequence of ageing and from the fact that not all diseases cause functional disability. This points to the need both to give more importance to self-assessment of disability and to the functional consequences of disability. Self-assessment of disability and the quality of personal life will also incorporate the fact that the perception of disability and quality of life is an outcome of public attitudes and cultural wisdom.

Self-assessed health status indeed has been proven to be an excellent indicator. People are able to assess their own health status fairly correctly as is proven by the good relationship observed in various studies between self-

perceived health and the real or future health status. Self-perceived health status is a reliable predictor of survival. There exists coherent correspondence between self-declared health status and diagnosis, treatment and functional conditions. Self-assessment of health status and of level of functional disability works well because individuals associate it with independence, autonomy and ability to be in control and life satisfaction.

The need to look at the functional consequences of disability is an indication that the health of a population is not only measured by the prevalence of diseases or impairments. The study of disability has both health and social dimensions that reach beyond illness and injury. Disability extends beyond the measurement of encounters with illness or injury to the assessment of remaining long-term human functions and activity after surviving episodic illness or coping with chronic conditions of injury and trauma. Disability is thus not so much concerned with the curative aspects of disease but with the quality and the functional aspects of daily life. This requires a focus on tested abilities such as vision or hearing as well as on performance in daily life. This has the advantage of transcending the dichotomous character of ability/disability by using different levels of disability based on cross tabulations by tested abilities and performance.

How do we determine the cause of death of the oldest age groups?

The accuracy of cause of death at higher ages, especially beyond age 75, is open to many questions. There are enormous differences between countries in means of ascertaining, coding and classifying the causes of death, raising serious questions of comparability. The fact that the frequently used 'Other' category and ill-defined causes is systematically higher in some countries certainly is an indication that different approaches and criteria are being used in stating the cause of death of the elderly. Due to these problems the existing evidence is often not conclusive enough to determine the relative contributions of various mortality causes as, for example, in the case of stroke and coronary heart disease. The fact that the decrease in mortality for the older groups is a recent phenomenon makes it impossible to have time series on changes in the causes of mortality and in their relative importance in order to draw firm conclusions or make plausible projections for the medium and long term.

An important issue is whether the improvement in mortality is primarily the result of a decline in the incidence of a particular disease or of an increase in survival of the same disease. Separate incidence and survival data are normally difficult to obtain. Hospital based incidence and survival data are usually unsatisfactory as they do not identify all non-fatal cases treated in the community. Furthermore, changes in diagnostic sensitivity may influence incidence rates.

Lack of availability and quality of additional data make study of the underlying causes of mortality difficult. For example, to verify whether social factors continue to play an important role in mortality at the older ages, information on past occupational indicators is often used. This information is often lacking or of doubtful quality. Furthermore occupational indicators might be inadequate for the purpose of studying socioeconomic differences in old age mortality. Better information is also needed for neutralizing the effect of selection. For example, life expectancy at age 100 is lower in Paris than in the rest of France. Does this mean that it is better for centenarians to leave Paris or do more older people with health problems come to Paris for treatment which is not readily available in small towns?

The future course of mortality for the elderly in the high mortality countries should be a primary concern of policy makers. Depending on whether further mortality reductions can be expected for the elderly, policy-makers will be confronted by two important policy issues. One issue is how many more resources must be set aside for the expected increase of the elderly population. The other is whether or to what extent policy makers can or should accelerate the course towards lower mortality among the elderly.

Mortality at the oldest ages in low mortality countries has declined sharply over the last three decades relative to mortality of the younger old. To have treated mortality at the very old ages as unchangeable, at least in the immediate past would have been a serious mistake. Will we make a similar mistake by assuming that the decline in mortality rates at the higher ages will plateau or will we delude ourselves by overly optimistic, if not Utopian, expectations of substantial future improvements? Unfortunately, policy makers will not find an unequivocal answer to this question in the scientific literature. However, familiarity with the debate should provide them with a framework for cautious action. The answer to this question is rooted in considerations of the basic causality of ageing and of mortality at the older ages.

Basically there are two schools of thought in regard to this issue. One, dominated by molecular and evolutionary biologists, takes the view that human life expectancy is rapidly approaching an inherent biological ceiling. Genetic characteristics of humans set upper limits to life expectancy which, at most, can only reach about 85 years; the point some have called the 'value of natural life expectancy '. For the sake of this discussion we will refer to this group as the 'natural limits school '. The other more optimistic group holds that mortality at the older ages is still subject to important improvements and that life expectancy will continue to increase in the near future. Some of the most optimistic adherents of this school even predict that life expectancy could increase to about 130 years.

Other prognoses are more in the middle and predict life expectancy of about 102 and 106 respectively for males and females towards the end of next century. This school consists mainly of demographers and public health specialists. We will refer to this group as the 'longer life school '. At their extremes the predictions of the two schools result in widely different prognoses for the future trend in life expectancy. However, if more emphasis is placed on what the two have in common, their prognoses are much more compatible. In fact the division into two schools simplifies the much larger and partially overlapping diversity of opinions which exists in actual reality.

The 'Natural Limits School': Rapidly approaching inherent biological limits to the increase of life expectancy

The natural limits school, grounded in the fundamental biology of ageing, takes a broad look at the history of human mortality and asks why ageing occurs. It concludes that the range of high life expectancies predicted by the longer life school are unattainable because of inescapable biological limits.

Since humans have inhabited the earth, for about 100,000 years, intense mortality selection pressures have produced a consistent, long-term pattern of high unstable death rates with extremely high attrition rates at younger ages. The mortality transition through which all populations of the earth eventually pass is but a tiny dot on the time scale of human history. But as a result of this epoch making transition, the prevailing forces of natural selection are profoundly changed. Survival past age 60 is now common. This is twice the age required by the life strategy for successful reproduction.

Human life strategy, the product of environmental conditions characteristic for the 100,000 years since homo sapiens first appeared, is characterized by the concentration of fertility into the second and third decades of life and the low probability of survival into older ages for the majority of the population. For most of human history senescence was a rare event only experienced by a minority of the population. Ageing could not have resulted as part of our life strategy. Senescence results from a necessary conflict between the allocation of energy to maximize reproductive fitness and the energy needed to maintain the body. Investment in the maintenance of the body to obtain immortality could only be obtained at the expense of reproductive success. Mortality patterns associated with senescence reflect the human capacity for post-reproductive maintenance of the body and its survival. This process of post-reproductive maintenance has its inherent limits because the genes whose deleterious effects are restricted to late in life accumulate in the gene pool because of their beneficial effects early in life. Somatic maintenance and repair mechanisms will remain operative at a high level of efficiency for approximately the first 30-40 years. Beyond this range the force of natural selection should decline, additional gains in fitness should be minimal and the death rate should begin to increase rapidly. What we identify as senescence in organisms that live beyond their reproductive period represents the inevitable consequence of unprecedented survival in older ages. There is no programmemed senescence but neither is there an active genetic programme for immortality.

An unchanged characteristic of the mortality patterns of humans is that the death rate has always begun to double every 8 to 9 years beginning in the fourth decade of life. Both the presence and intransigence of Mortality Rate Doubling Time (MRDT) have been observed in other species. An unyielding MRDT may represent a fundamental characteristic of the species. Senescence is inevitable for any sexually reproducing species. Rate of somatic decline can be affected by personal behaviour. However as survival extends further beyond the period of reproduction, opportunities for decelerating senescence decline because of the inevitable accumulation of damage to maintenance and repair mechanisms. Therefore it is wrong to assume that the anomalous trend in mortality observed for a few older age groups for a brief moment in time can be sustained.

Many adherents of the natural limits school accept some or most aspects of the so-called theory of the 'compression ' of morbidity and of the ageing process. Morbidity and the ageing process, as a consequence of changes in life style and in preventive health measures which are responsible for recent improvement in old age mortality, will be compressed into a shorter period of time. As a consequence, mortality itself will be compressed in time because the improvements in mortality are quickly approaching a biological ceiling. As sources of premature mortality would be eliminated, genetically programmemed senescence would make it very difficult to reduce mortality at the older ages. Some even feel that the compression of the time allowed for morbidity may well cause an increase in the severity of disease itself or the appearance of new diseases.

This school also objects strongly to the thesis of the longer life school that life expectancy attained by certain groups can be easily achieved by the general population. The hypothesis that the theoretical limits of life expectancy must lie near or beyond the life expectancy currently observed by the healthiest subgroup of the population is based on unrealistic assumptions about the general reduction of risk behaviour in the general population. The recent decline is unique and has wrongly caused demographers and epidemiologists to paint an unrealistic picture for the future. It is also based on an underestimate of the importance of biological factors to explain the variability of mortality at the older ages as compared with variability at younger ages.

The 'Longer Life School': Vast scope for further declines in mortality at the older ages

Those who see further possibilities for substantial decrease in mortality at the older ages point to the necessity not to look exclusively at biomedical and genetic factors but also at three other groups of factors: behavioural and lifestyle factors; environmental factors; and access to and use of health care. Many of the major chronic diseases are linked to life style factors which include smoking, use of alcohol and addictive drugs, quality of nutrition, over-use of medicines, lack of exercise and unsafe sexual practices. Even in regard to the biomedical and genetic factors many of them propose a more flexible position. They find their optimism confirmed in current mortality trends at the older ages which they feel are the harbingers of continuous future change.

In regard to the fundamental biology of ageing they feel that biological limits, if they exist, are moving limits that can shift over time. The mortality transition should thus be viewed as consisting of several phases. The first phase was characterized by the reduction of infectious disease. The second phase will be predominantly a decline in the rate of degenerative disease as a consequence of a better understanding of the role of risk factors in the development of degenerative diseases. Some authors predict a third phase during which the degradation process itself will start to decline, based on the view that these diseases are simultaneously influenced by a set of risk factors and by an intrinsic process of degradation of organisms.

Box 4: Mortality Differences for the Elderly in Finland

A study from Finland allows more robust conclusions to be drawn because it is based on a massive study of the records of four censuses encompassing the period from 1970 to 1990. In Finland these records can be linked to death registration. Five sociodemographic variables were used: occupational class, education, marital status, language and region of residence. The study unambiguously shows that there are quite distinct sociodemographic differences in mortality among the Finnish elderly. Occupational class and educational differences were most pronounced. Using combinations of the five sociodemographic indicators, a number of smaller sociodemographic groups were defined. As could be expected, greater differentials appeared for these smaller groups. The highest mortality group has twice the mortality of the lowest mortality group.

The Finnish study also focused on whether there was a tendency towards convergence over time. The data do not show any consistent trend towards convergence. The rate of decline among men tended to be faster in those sociodemographic groups where mortality was already low at the beginning of the period under observation. Among women the differences tend to persist but changes are less consistent than for men.

From this study it can be concluded that there is still lot of scope for improvement, especially in view of the fact that a considerable part of the differences seems to be due to behavioural factors such as smoking and dietary habits which are different from one group to the other. However everything cannot be explained by these factors and genetic factors may also play a role.

Using the classic demographic distinction between exogenous and endogenous causes of mortality, it is argued that as the importance of exogenous factors will be increasingly reduced by the elimination of current major causes of mortality at the older ages, specifically cardiovascular diseases and cancers, it will be possible to directly impact on the underlying non-disease-related fundamental causes of age changes and to obtain major advances from acting on the causes of intrinsic ageing or senescence. According to the longer life school many general endogenous processes are affected by both reduced physical activity and relatively poor nutrition which produces degenerative changes in multiple metabolic and physiological parameters affecting morbidity.

The epidemiological study of mortality differences for the elderly is an important source for ascertaining the potential role of behavioural, environmental and health care factors.

Do differences, especially sociodemographic and socioeconomic ones, persist for mortality in the older age groups? Some hypothesize that such differences become less important at the older ages because the increasing importance of endogenous causes would favour convergence of mortality differences.

Taking countries or smaller geographic areas as the unit of observation one can see on one hand that among the countries with the highest rate of survival over 60 there are countries with important cultural differences from both Southern Europe and Japan. Some authors, looking at regional factors within low-mortality countries or geographic regions conclude that regional differences play a relatively minor role in influencing mortality levels and age patterns as well as gains in life expectancy at the older ages. On the other hand, important differences in

old age mortality persist between Eastern Europe and the other parts of Europe reflecting differences in political systems and the traumatic experience of the transition to new political systems.

In a study including all European countries, Israel, Japan and USA which used economic variables such as per capita income and income inequality, results were obtained which suggest that economic development is related to mortality levels throughout the full age range. At the oldest ages the relationship appears to be as strong as among the young old and those in late middle age.

The above studies evidently have the typical weakness of studies where the unit of observation is not the individual. When using the individual as the unit of observation the results are somewhat ambiguous. In several more medically and geriatrically oriented studies, socioeconomic factors have been reported to have no or only weak relationships with old age mortality. It should be noted, though, that these studies tend to have a small number of subjects and that it often is difficult to infer meaningful conclusions from these small numbers. Another disadvantage is that they typically concentrate only on the very old age groups. More comprehensive and large scale epidemiological studies continue to show important regional and socioeconomic differences in mortality at the older ages as the example from Finland in Box 4 shows.

Box 5: How do Women and Men Fare in Survival, Causes of Mortality and the Quality of Life at the Older Ages?

Mortality differentials and life expectancy by sex widened dramatically during this century. The trend was clear between the 1930's and the 1970's. Around 1990 sex differentials in life expectancy for Europeans from age 60 to age 85 varied from 5.1 (Greece) to 9.6 (former Soviet Union). Sex differentials in life expectancy from age 60 to 85 contribute significantly (from about 35 percent to about 60 percent) to sex differentials in life expectancy at birth. For virtually all causes of death female age-specific mortality rates are lower than for males. The higher male mortality ultimately results in very high proportions of women above age 85, sometimes more than twice as many women than men. The surplus of women is even more marked for the centenarian population which consists mainly of women, as many as seven times more than males.

Whether these differences will narrow, remain stable or increase is a moot question. The course of mortality differentials during the recent decline in old age mortality is ambiguous. Some counties experienced declines in the overall sex differential in life expectancy with the largest reductions recorded by Australia, Finland, the USA, the UK and West Germany. On the other hand there were increases, especially in several East European countries. These changes, compared with the current magnitude of the differentials, however, remain very modest.

The basic reasons for the sex differentials remain controversial and they certainly reflect the influence of both biological and sociological variables. If we look at detailed age-sex specific patterns of life expectancy at the older ages we find few systematic patterns of sex differences which suggests that differences in cause of death, including social and cultural factors, may be operating. The sex differences in the pattern of morbidity and mortality, in fact, can be quite complex. For example, in most populations more men than women develop cancer. However women living with cancer outnumber men by as much as two to one because the most common cancers among women in developed countries, usually those of breast, colon, uterus and cervix, confer better survival conditions than the cancers which are most frequent in men.

There are researchers who feel that the importance of mortality differences by sex will tend to decline at advanced ages because hormonal and other gender-related physiological characteristics will decline. However many data do not seem to support this conclusion. It should also be pointed out that reduction in sex differences could in part be due to women shifting toward life styles damaging to health which were previously the domain of men only.

How does the quality of life at the older ages compare between men and women? First of all it should be noted that the answers may be different depending on the definition used for disability. With more encompassing definitions of ability women have higher disability rates than men. Most studies show that the ratio of disability-free life expectancy to regular life expectancy is higher for males than for females. Many studies report higher rates of Alzheimer's disease for women. Depressive disorders are more than twice as common among females as among men for those 80 years and over. When comparing the ability to perform certain activities of daily life, women experienced more difficulties than men. However this definitely is not true for all aspects of daily life. The ability to do light housework was better for women than men.

A closer inspection of the directly medical causes of mortality at the elder ages also shows that there is scope for reduction with increased possibilities for expansion in life expectancy. A major decline in mortality among the elderly is mainly due to favourable trends in pathologies such as diseases of the circulatory system and certain types of cancers which are caused by risk factors closely linked to individual life styles and the population's socio-cultural conditions. For example, there is considerable evidence that a large proportion of cardiovascular disease in the elderly is potentially preventable and treatable. First, cardiovascular disease mortality rates vary considerably internationally. Most of the variation in national mortality rates above 74 is now due to only three causes of death all diseases of the circulatory system: heart disease, cerebrovascular disease and atherosclerosis. It is very unlikely that this is due to genetic differences. Prospective cohort studies, where a group of persons born in the same period are followed over time, have elucidated risk factors such as raised blood pressure and smoking which are potentially modifiable by life style changes. Experiments with dietary intervention or treatment of raised blood pressure have indicated that modification of risk factor levels can reduce cardiovascular mortality and morbidity even in the elderly. The example shows the possibility of two approaches to intervention. One is the 'high risk approach' in which those at high risk, such as persons with high blood pressure and/or high serum cholesterol are identified and their risks treated. The other is the 'population approach' which aims to reduce risk factors in the population as a whole.

As the mortality of the elderly population improves, the quality of life of the elderly is emerging as an important scientific and policy issue. Do people, as they live longer, enjoy good health and satisfaction of life in general or are they more subject to disease and disability? The answer to these questions evidently has two important policy implications. Should policies favour the allocation of more resources to simply increase the length of life or should improvement in the quality of life of the elderly receive priority?

Scientific evidence remains controversial and hence the policy implications cannot yet be clearly identified. Some hold, on the base of theoretical insights and/or empirical data, that increase in life expectancy is inexorably accompanied by deterioration in the quality of life for the elderly. Others take a much more optimistic view. Let us briefly summarize the arguments used in support of these opposite views. Keep in mind that there is a substantial, but not complete, overlap of these two views with the previously described natural limits and longer life schools of thought in relation to the future evolution of mortality at the older ages.

Increase in life expectancy is inexorably accompanied by deterioration in the quality of life for the elderly

According to this group, the mortality transition at the higher ages is accompanied by a disability transition, a term used by several authors who defend the view of the deterioration in quality of life for the elderly. Before the mortality transition only a small proportion of life was spent as a disabled person. The disability transition implies that relatively longer periods are spent in ill-health and disability as longer life expectancies are reached. It is a stage of longer life but worsening health. The ratio of disability-free life expectancy to total life expectancy will decline. The extended survival beyond the ages required for successful reproduction will therefore be associated with a never-ending and progressively more difficult battle against the disorders of old age. In general the dysfunctional consequences of disease become more serious with increasing age, especially at ages above 70. After recovering from an illness many old people fail to regain all their abilities completely. True, there will occasionally be new medical successes and opportunities for health improvement. However these developments will result in ever diminishing returns and a never-ending battle with the fundamental causes of senescence. There is a tradeoff between lower mortality and morbidity from fatal disease for a small increase in life expectancy and accompanying increase in the duration of time for the expression of non-fatal diseases of ageing. Tampering with the biological clock will just add years of suffering.

According to some, the decline in mortality rates is primarily the consequence of declining fatality rates for chronic diseases rather than a decline in the incidence of these diseases or a slowdown in their progression. The postponement of death will therefore simply result in a worsening of the severity of chronic diseases. Some have argued that all persons would eventually experience dementia if life expectancy were extended indefinitely. We do not even know yet how to delay the progression of the most common non-fatal ageing related diseases such as Alzheimer's disease and sensory impairments.

Contrary view: Increase in life expectancy can be accompanied by maintenance of the fundamental quality of life for the elderly

First of all it should be underlined that not all elderly persons experience a deterioration in the quality of their life. Some persons at age 75 have the functional ability of 30-40 year olds. Nor is there any evidence for the view that ultimately all the elderly would become demented as life expectancy continues to increase. It is true that Alzheimer's disease, the most common disorder leading to dementia and representing about 50 percent of all dementias, rises steeply with age after 60. While only about 6 to 7 percent of 65 year olds are affected, the

prevalence rises to about 35 percent for those 85 and over. Plenty of data, however, show that Alzheimer's disease continues to affect only a finite proportion of the older population.

More generally, the trend from the most recent data does not support the conclusion that frailty of the older population has increased in the past few decades. A careful inspection of the course of life expectancy without severe and with very severe disability shows that they are at least on a parallel course with total life expectancy. While many researchers accept that there is a pandemic of light and moderate disabilities as people grow older, this is not the case for severe disabilities. Rather what is happening is the simultaneous occurrence of an increase in the prevalence of light or moderate disability with a levelling or a fall in the prevalence of severe disability. The increase in life expectancy has to be partly explained by a slowing of the rate of progression of chronic diseases. So, although the decline in mortality leads to an increase in the prevalence of chronic diseases these diseases will generally be milder in character. Ultimately this will result in a decline in the ratio of total disability-free life expectancy to total life expectancy because of the increase of minor disabilities but in a levelling or an increase in the ratio of severe disability-free life expectancy to total life expectancy. Many researchers do not find evidence for the compression of mortality. Even those from the optimistic school who accept a tendency towards compression, are convinced that the compression of mortality will be accompanied by increases in disability-free longevity.

Many studies, according to the optimistic school, support the elasticity model of ageing which proposes that the level of functional abilities does not necessarily decline with age according to natural laws. Functional disability among the elderly is not necessarily or solely the consequence of biological-chronological ageing. Although many abilities such as the ability to go to places without help, the ability to negotiate stairs, the ability to do light homework decline with age, they can remain high among a substantial proportion of the elderly. Many abilities also can be maintained at high and sufficient levels with the help of proper services and prevention of prejudices.

Morbidity and mortality from neurological and psychiatric disorders are very common in older populations. Depression is the most prevalent mental disorder in the elderly but the symptoms can be masked by the symptoms of other diseases or appear as signs of ageing. However there are no definite trends indicating either decreased or increased incidence in these diseases which cause cognitive and physical impairment and lead to institutionalization. It should also be emphasized that many exogenous factors can cause depression such as physical and psychological isolation and the loss of spouse, other family members or friends. Furthermore it should also be underlined that the occurrence of major depression is lower among the elderly than among young adults.

Much research suggests that the scope for the prevention of certain disabilities may be great. The potential to successfully treat disease among the elderly has recently been shown to be significant. The incidence of disabilities and diseases among the elderly can be affected by action on risk factors. Old people can change their life style and control at least in part some of these risk factors. Research has also shown that there can be substantial differences among birth cohorts, an indication that secular changes will have an impact on the incidence of disability among the elderly. Also useful to point out is that in cohort studies, although in most cases functional ability decreased with age, in some cases it improved.

Policy Conclusions

The World Assembly on Ageing, which took place for the first time in Vienna in 1982 called official attention to the issue of population ageing at a global level and put it in sharp dimension before the eyes of policy makers. What should policy makers then do in the face of the many uncertainties which have been presented here in an unambiguous and straightforward manner? Inaction would be inappropriate. In fact there are four areas where policy makers definitely can make a crucial difference.

1. The ageing of the population, both as a consequence of the decline in fertility and of the unexpected and substantial improvement in life expectancy at the elder ages is now a well documented fact in the low mortality countries. While the 20th Century can be characterized as the 'Century of Population Expansion', the next century will be that of 'Population Ageing'.

These facts can be expected to appear soon in the currently developing countries. Several developing countries are quickly approaching the point where these issues are increasingly relevant. Japan demonstrates the acceleration of the process compared with Western countries. The population 65 and over was predicted to be 14 percent of the total population by 1996. In reality this figure was reached by 1990. Japan only required 20 years to go from 7 to 14 percent for the population 65 and over. In France it took 85 years in the UK and Germany 45 years. In the USA it will require 75 years. Thus it is important that policy makers facilitate the collection and analysis of data on the mortality of the elderly. The issues discussed in this monograph show that their full understanding depends on better conceptualization of and improved data on smaller subgroups of the elderly.

Furthermore a better insight into the transition toward the third and fourth age will depend both on in-depth analysis of better demographic and epidemiological data and on support for fundamental research in molecular and evolutionary biology.

2. Policy makers should realize that sound biological insights into the fundamental process of ageing will provide an antidote against simplistic rosy expectations about the future course of mortality and life expectancy at the older ages. The absence of this insight has led some to the extreme positions implying the negation of any inherent limits to longevity. On the other hand, the exploration of the more optimistic position has shown that there definitely is scope for further improvements in health for the elderly and which do not require expensive investments in medical technology. The achievement of smaller variations in spatial mortality and among socioeconomic groups does not necessarily require new drugs, new cures or new technologies. Policy makers can make contributions to these improvements especially by creating conditions for shifts toward healthier life styles and appropriate health care for the elderly.

3. The goal of programmes and policies should not be the mere reduction in mortality but also the improvement in quality of life and in independent living. The allocation of resources should emphasize the addition of 'life to years' rather than the mere addition of years to life.

Emphasis on the quality of life will require reorientation in the allocation of resources in many different areas. The current strategy gives top priority to resources for research in the field of highly lethal disease. This strategy must be redirected towards more emphasis on the treatment of diseases which do not cause death directly but which greatly worsen quality of life such as mental illness, arthritis and arthrosis or even the more simple problems related to hearing, teeth and mastication. Increased scientific research is needed for the treatment of common diseases which limit full physical, psychological or cognitive efficiency.

It will also require reorientation in the management of human resources and in the training of professionals in related fields. Far too many paediatricians and primary school teachers are being trained in the low mortality countries. Investment in the development of these human resources should diminish while the training of physicians, nurses and social workers with geriatric skills should be increased. Courses on the medical, psychological and social aspects of disablement should be established in training programmes of public health, epidemiology, demography, medicine and social work. It should be recognized that general skills in these areas are not sufficient to deal with elderly health problems and the problems of co-morbidity, which are more frequent among the elderly.

Development of sound policies will also require reorientation in the attitudes of individuals and communities toward the elderly which can significantly improve their quality of life. For example, the physical access of the elderly to many community and other services can be easily changed without major investments. In fact it could be argued that such improvements will enable the community to save on other types of assistance to the elderly. Community expectations enhancing the ability of many elderly to do meaningful work and to be valuable members of the labour force should be encouraged. While increasing the quality of life for many elderly it also would reduce the economic burden which is being augmented by the growing population of elderly.

Box 6: Japan, the Country with the Highest Life Expectancy in the World

Japan is currently the country with the highest life expectancy in the world, both for males and females. In 1991 life expectancy was slightly over 76 for males and slightly over 81 for females. Japan's current position is even more astonishing when we consider both that its life expectancy in 1951 was well below the level enjoyed by most modern nations and that Japan's life expectancy continues to grow faster than that of other countries with very high life expectancies.

A major portion of the Japanese mortality decline over the last 100 years has been a matter of catching up with the low mortality countries. During this period life expectancy has more than doubled. Even after 1950 it increased by more than 15 years for males and nearly by 20 years for females.

In the early twentieth century infectious and parasitic diseases were the major causes of mortality and responsible for the high infant and childhood mortality. These causes continued to be important even immediately after the Second World War. Therefore the decline in mortality between 1955 and 1960 due to the four infectious diseases combined namely gastro-enteritis, tuberculosis, pneumonia and bronchitis, made important contributions to the increase in life expectancy over that period: 46 and 38 percent respectively of the increase in male and female life expectancy. Vigorous public health activities to control infectious diseases and the use of antibiotics played a major role in the control of these mortality causes. By the mid- sixties infant and childhood mortality, however, had declined so much that further increase in life expectancy from this source had become negligible.

The rate of increase in life expectancy decreased after 1965. However, while gradually approaching and then surpassing Western standards, a new pattern of age specific mortality decline emerged. The greatest contribution accounting for an increase in longevity has shifted from the younger to older age groups. After 1965 increase in life expectancy became predominantly the consequence of mortality trends at the middle and older ages. During 1975-85 the largest contributions to the increase in life expectancy came from the 65-79 age group. Over the 1955-1960 period 55 percent of the improvement in male life expectancy and 46 percent of the improvement in female life expectancy were due to the decline in childhood mortality. For the 1985-1990 period declines in childhood mortality were responsible for improvements of only 7 and 6 percent of male and female life expectancy. In contrast, over the same period declines in mortality above age 65 contributed respectively 50 and 69 percent of the improvement in life expectancy.

As the age pattern of mortality changed there was a remarkable change in the causes of mortality. The role of non-infectious disease has been gaining in importance in determining the length of life. In 1990 malignant neoplasm followed by heart disease and cerebro-vascular disease were the most important causes of mortality. An interesting case is the role of cerebro-vascular disease. Traditionally the mortality rate form cerebro-vascular disease has been considerably higher in Japan than in European countries except for Italy. It has been declining rapidly and substantially in recent years. Its decline is one of the most important features in the evolution of mortality in post-war Japan.

The reason why cerebro-vascular disease in Japan was higher than in Europe and is now declining as a cause of mortality is that traditionally salty food was an important ingredient of the Japanese diet. With increasing standards of living the diet has shifted toward less salty, more protein rich food. The introduction of the refrigerator in the Japanese household has lessened the use of salt for the purpose of preserving food, and has enabled the Japanese to eat more fresh food and has gradually changed Japanese taste itself. The diffusion of heating systems in the house has helped in preventing elderly brain hemorrhage. It is also hypothesized that the recent tendency of eating western type of animal protein rich foods could result in stronger blood vessel tissues and in less vulnerability to cerebral hemorrhage.

The course of life expectancy and mortality at the older ages in the immediate future is the subject of intense debate. Further improvements seem to be possible, at least up to a life expectancy at birth of just below 80 for males and just over 85 for females. Such a conclusion is warranted on the basis of several observations. One is seen on the island of Okinawa, the prefecture with the highest life expectancy in Japan. Although Okinawa has the lowest per capita income among Japanese prefectures female life expectancy in 1990 was more than two and a half years above that of other Japanese women. For males there is a definite but smaller difference in the same direction. The discrepancy is not caused by any deficiency in Okinawa's death registration system. Like all Japan, mortality among the middle and old ages in Okinawa virtually explains the overall lower mortality in comparison with the whole of the country. Differences in mortality from heart diseases, cerebro-vascular disease and malignant neoplasm constitute 93 percent of the difference. Differences in dietary habits, the consequence of a strong Chinese influence, seems to be the most important factor in explaining the more favourable survival prospects of the inhabitants of Okinawa.

Another consideration confirming further possibilities for increase in life expectancy comes from the fact that mortality continues to decline at the older ages at a steeper rate than in Western countries. A distinct feature of Japanese mortality is the low incidence of mortality due to heart disease. However there is still room for further declines in heart disease which could offset possible increases in mortality especially from the heart and from cancer, consequences of modernization and westernization which thus have been shown to have influence in two directions. For example male cardiovascular mortality risks in Japan remain lower than in the USA despite a higher smoking rate among some groups.

Increased emphasis on the quality of life, paradoxically, will also increase attention to the ethical problems surrounding the issue of the right to death of persons in conditions of possibilities for extended life survival requiring the use of extremely expensive technologies resulting in meaningless short additions to life which may be drenched with misery, taking away the human dimension of human life itself.

4. The costs of health services for the elderly will become a growing issue for policy makers. Increasingly the most important health policy decisions in low mortality countries will relate directly or indirectly to the health needs of the aged. For example, persons over 60 years in Australia account for 80 percent of all deaths, 50 percent of all acute hospital beds, 26 percent of expenditures on pharmaceuticals and almost all nursing home and hostel beds. After age 50 health expenditures per person rise significantly with increasing age. In 1989-90, again in Australia, total health expenditures on people over 65 was four times greater than on those under 65. For pharmaceuticals it was 4.4 times higher, for medical services 2 times higher, for hospital expenditures 4.3 times higher. In 1991 medical care for the elderly was about 29 percent of the total medical care expenditures in Japan. Medical expenditures of age group 70-74 was ten times that on age group 0-14. The use of health services in older ages is not so much due to chronological age. Rather it relates more to proximity of death and is reflected in the very high expenditure in the last two years of life.

Policy makers, in the allocation of resources for the elderly, will be increasingly confronted by equity and ethical considerations. The percentage of people over 60 could exceed 40-45 percent and that of over 80's 10-11 percent in the future. An age group that becomes so overcrowded cannot be sustained by the rest of the population from any point of view including the psychological one. The question to what extent the distribution of medical and related expenditures should be equally distributed over all age groups and whether in the allocation of resources the emphasis should be on health versus death prevention needs will take on increasing relevance. Concern about rationing of health services according to age and to the possibilities for meaningful survival will become one of the criteria in health care for the elderly. Rather than pushing it under the table and letting it grow in unrecognized forms this issue must be squarely faced.

Policy makers will increasingly need to look at the cost containment and the sustainability of current levels of health service as the proportion of the inactive population grows. The over-eighty group has grown or is currently growing in many countries at an annual rate of 3 to 4 percent. It will be difficult, if not impossible, for resources to grow at that rate. Furthermore, the pressures on the financial resources of the government will be compounded by the shift away from family or informal community care. Although the proportion of elderly living with children is still higher in Japan than in the West, it definitely is decreasing. This trend will be increasingly shared by developing countries with sharply declining mortality. New and cheaper methods of health care for the elderly will be needed.

It will be imperative to explore all reasonable avenues for effecting savings in the health budget for the elderly. This is leading in many countries to fundamental reforms of public medical insurance systems. There will be an irresistible tendency towards cost sharing on the part of the elderly. Concomitantly the proportion of the elderly who can share and the extent to which they can share costs will become subjects of intense debate. With changes in family structure the very concept of care of the elderly has to be rethought. Service provision tends to be overmedicalized. In many countries there is over-use of the services offered by the general practitioner by the elderly which is unjustified by their real health status. The ideology of custodialism should be replaced by services which increase the scope for autonomy among the elderly. Deinstitutionalization of elderly care is needed and the provision of outpatient services and home services for the elderly will need to occupy a more important place. The over-use could be done away with by recognizing their need for some form of assistance which is not necessarily of a medical nature. Often health and welfare for the elderly can be combined resulting in both better care and more efficient use of resources.

Conference on Health and Mortality Trends Among Elderly Populations: Determinants and Implications

List of the papers presented at the Conference on 'Health and Mortality Trends among Elderly Populations: Determinants and Implications' organized by the IUSSP Scientific Committee on Adult Mortality and the City of Sendai, held at the Japan Aging Research Center of Sendai from 21 to 25 June 1993

Session 1: The Fourth Stage of Mortality Transition: Trends in Mortality and Survival Among the Elderly

- 'Comparative Study of Mortality Trends Among Older Persons in Developed Countries' by George C. Myers
- 'A Relational Model of Mortality at Older Ages in Low Mortality Countries' by Christine L. Himes, Samuel H. Preston and Gretchen A. Condran
- 'Socio-Demographic Mortality Differentials and Trends Among the Aged in Finland in 1971-90' by Tuija Martelin
- 'Old Age Mortality' Sex Differentials and Spatial Variations' by Thomas Beuttner
- 'Recent Trends in Mortality Rates Among the Elderly in Selected Low Mortality Developing Populations' by Alex Kalache

Session 2: Morbidity and Disability Trends Among the Elderly

- 'Overview of Trends in Morbidity and Disability in Ageing Research: Evidence from Censuses and Surveys' by Mary Chamie
- 'Trends and Differentials in Disability-Free Life Expectancy' by Jean-Marie Robine, Colin Mathers and Nicolas Brouard
- 'Disability and Functional Status Among the Elderly as Based on Structural Interviews and Follow-Up Studies for Selected Countries of Europe and Other Regions' by Eino Heikkinen, J. Jokela and M. Jylhä
- 'Morbidity and Mortality from Neurological and Psychiatric Disorders Among the Elderly' by Matti Viitanen and Bengt Winblad

Session 3: Role of Social and Biological Factors in Old Age Mortality

- 'Demographic and Biological Perspectives on Human Longevity' by S. Jay Olshansky and Bruces A. Carne
- 'Mortality Among the Oldest Old: Causes of Variation Among Low Mortality Countries' by Eileen M. Crimmins and Yasuhito Saito
- 'What is Old Age? Variation Over Time and Between Cultures' by Peter Laslett
- 'Social Support, Life Satisfaction and Survival at Older Ages' by Emily Grundy, Ann Bowling and Morag Farquhar
- 'Determinants of the Health and Survival of the Elderly: Suggestions from two Different Experiences - Italy and Israel' by Antonella Pinnelli and Eitan Sabatello

Session 4: Diseases and Conditions Affecting the Health and Survival of the Elderly: Demographic and Epidemiological Analyses

- 'Changes in Mortality, Morbidity and Natural History of Cardiovascular Diseases Among the Elderly' by Kay-Tee Khaw
- 'The Changing Epidemiology of Cancer at Higher Ages: Determinants and Implications of Trends in Incidence, Survival and Mortality' by Michel P. Coleman
- 'Health and Survival of the Elderly: Evidence from the Gothenburg Longitudinal Study' by Alvan Svanborg
- 'In Search of the Secret of Centenarians: A French Demographic and Medical Survey about Centenarians' by Michel Allard, Jacques Vallin, Jean-Michel Andrieux and Jean-Marie Robine

Session 5: Projecting the Health and Survival of Elderly Populations

- 'Evaluation of Mortality Projections for the Elderly: National Population Projections in Industrialized Countries' by Frans van Poppel and Joop de Beer

- 'Future Longevity Among the Elderly: Causes of Death and Survival at the Dawn of the 21st Century - An International Perspective' by Graziella Caselli
- 'Multiple Pathologies in the Extreme Elderly: Changes by Sex and Age Mortality in U.S. Patterns 1980 to 1989' by Kenneth G. Manton and James Vaupel
- 'The Influence of Disease Factors on Health Status and Mortality Projections for Aged Populations' by J.E. Dowd, K.G. Manton, E. Stallard and M.A. Woodbury

Session 6: Ageing and the Health of the Elderly in Japan: A Case Study

- 'Mortality Projections Among the Aged in Japan' by John R. Wilmoth
- 'Health and Mortality Differentials Among the Elderly in Japan: A Regional Analysis with Special Emphasis on Okinawa' by Shigesato Takahashi
- 'Role of Nutrition and Life Style Factors Versus Biological Factors in Longevity of the Japanese Population' by Takao Shigematsu and Zenji Nanjo
- 'Life Style and Care for Preventing Pneumonia in the Elderly' by Hidetaka Sasaki, Kenichi Meguro and Kiyoshi Sekizawa
- 'Implications of Population Ageing and Health Trends Among the Elderly for Japanese Society and Economic Growth' by Tetsuo Fukawa

Session 7: Policy Implications of Morbidity Trends and Increasing Survival at Advanced Ages

- 'The Growth of Health Expenditures for the Elderly' by Antonio Golini and Roberta Vivio
- 'Strategies for the Provision of Care to the Elderly by Social and Health Services' by Ann Kern
- 'Public Health Policies for an Ageing Society' by Nobuo Onodera
- 'The Need to Develop a New Medical, Social and Economic Culture of Formal and Informal Care' by Svein Olav Daatland

The International Union for the Scientific Study of Population (IUSSP) is the foremost international professional association dedicated to the scientific study of population. Its four basic objectives are:

1. encouragement of research into demographic issues and problems world-wide;

2. stimulation of interest in population questions among governments, international and national organizations, the scientific community and the general public;

3. promotion of exchange between population specialists and those in related disciplines;

4. wide dissemination of scientific knowledge on population.

The Scientific Committees and Working Groups of IUSSP are the principal means of implementation of the scientific programme of the IUSSP. Generally they have a life of about four years. Scientific Committees are active in well-defined fields of research whereas the Working Groups are often established in newer areas in which the Council of IUSSP thinks further development and definition of scientific issues is required.

Additional information on the IUSSP and its scientific activities and publications are available on the website: www.iussp.org