Increased Longevity In Man

SIR CYRIL CLARKE, KBE, MD, FRCP, FRS
Director, Royal College of Physicians Research Unit

It is well known that in the UK the proportion of pensioners to the rest of the population is rapidly rising and in this article I propose to discuss the old and the very old, i.e. those over 85 years and especially centenarians.

The reason for my interest is that I believe it is not sufficiently realised that the old can give important epidemiological data about what accelerates or retards ageing and death.

Table 1 shows the nearly ninefold increase in centenarians in 30 years and this must have mainly environmental causes. It could not possibly be due solely to the increase in population size, nor could the genetic structure of the population have altered appreciably in this time. So we should look for environmental factors, of which there are plenty—antibiotics and other drugs, various caring aspects of the NHS, hybridity, the Clean Air Acts, health education, the ‘urge to live’, central heating, diet and all the rest.

All this is well known, but how do these factors rate at different ages on the way to the century? One clue comes from examining the sex ratio, shown in Table 2. What is so interesting is that women ‘take over’ only at about retiring age; they do this to such an extent that by the time the century is reached only about 15 per cent of these very old people are males. This could be because there is some biological basis for increased longevity in women, but it seems much more likely that it is the males who die differentially from about the age of retirement onwards.

The survival of the older women is exactly the opposite of what would be expected on the Darwinian theory of selection in favour of biological fitness, since this becomes zero in women after the age of 50—because they then cannot hand on their genes, whereas men can up to any age. So there must be causes working against men in older age groups and these are highly likely to be environmental factors, for example diseases.

It would be most interesting to see if these sex ratios are currently different in the different social classes, and to know the position 20 years ago and what is happening in other countries. Some readers may know the answers to these queries, which could indicate changing pressures on the sex ratio. In passing, if there is now a scourge of coronary heart disease deaths in males between 40 and 55 one might expect the sex ratio to be affected, but this is not the case, so I am uncertain how sensitive a marker it is. However, I obtained some useful information from two actuaries. They pointed out that 105 boys are born to 100 girls but because the mortality in children and young adults is higher in boys than in girls the sex ratio at age 25-34 is near unity (49.6). This might be because males are biologically inferior to females, but, if so, I do not understand why the sex ratio between 34 and 54 remains at unity; one would have thought the females should ‘nose’ ahead during this time, whereas they only start doing so between ages 55 and 64. A more likely explanation is that trauma is responsible for an increased death rate in boys and young adults and that between 34 and 54 males are developing but not dying from atheroma to a greater extent than women. After the age of 55 men start dying differentially, probably from cardiovascular diseas, and women ‘take over’ the sex ratio to an increasing extent in each decade.

Table 3 gives information about two cohorts, one between 1876 and 1945 and the other between 1961 and 1980. It will be seen that there is a marked reduction in mortality and surprisingly this is greatest in the younger age groups. So when considering factors prolonging life we have to take the age group into account as well as the sex ratio in that group.

The fact that each decade is receiving a contribution from the one before means that there is a cumulative effect such that there are bound to be more centenarians, and we need not look for a specific cause at or around the
The causes of survival will be building up but will be different in the different decades.

The current trend of increased longevity is described by what the Americans call ‘rectangularisation’ of the population, as shown in Fig.1. In the Stone Age, for example, only about 12 per cent of the population reached the age of 50, whereas in 1971 the percentage was over 90. As a nation, therefore, we are living longer, in spite of cigarettes, drink, drugs, the dreaded coronary artery disease and lung cancer. Have we reached the limit of age? Probably not. The Japanese have reported a definite example of a man living to 116.

Likely Environmental Factors favouring Survival

Antibiotics and Other Drugs

These are available equally to both sexes at all ages and may be the principal cause in the reduction of mortality in the younger age groups where the sex ratio is normal as indicated by the decline in tuberculosis and many other types of infection. But at retirement age and after, antibiotics will still be as effective in men as in women, and therefore it is probably not infections which are killing off the men differentially at 65 years or more.

The NHS and its Facilities

These will tend to prolong life after coronary thrombosis and strokes, and there is also the improved treatment of hypertension. The facilities, and the drugs, are available to both sexes, but I surmise that it is the cardiovascular diseases which kill off more men than women in the older age groups, probably because of male life-style in retirement.

Similarly, more men die of cancer, mainly because of the large number of lung cancer cases (the result of cigarette smoking) than women. So in the older age groups this cancer will favour the higher survival rate in females, at least at the present.

Health Education

This again is available to both sexes but after retirement men tend to adopt an unhealthy life-style. They run to fat because of excessive calorie intake and smoke and drink more than women. Furthermore, they are less active both mentally and physically—all things are in the bag, so to speak—whereas most women go on as before, cleaning the house, cooking the meals, shopping, washing, etc. There is no retirement for women, so they live longer; this is my view. Support, showing how women, compared with men, have kept cardiovascular disease at bay in the past 80 years, comes from the USA[1].

Hybridity

This is more speculative but it is a likely factor in the Japanese, where cousin marriages used to be common. A century ago one tended to marry the girl next door but with the coming of the internal combustion engine men became more venturesome and travelled further for their mates — so there would be less inbreeding and more hybridity and therefore possibly more hardiness. In animals it holds, for a mule, which is a cross between a mare and a jack donkey, lives longer than either of its parents.

The Clean Air Acts

These were very important. Pollution (i.e. sulphur dioxide and soot) will have affected men in their working life more than women, often without killing them until later. Lawther et al.[2] gave bronchitics pocket diaries for the daily recording of their health, with very simple coding, and showed that worsening was highly correlated with smoke and sulphur dioxide levels. With the Clean Air Acts these findings became of historical interest only.

The story of the Peppered Moth correlates well with the medical findings. In 1849 the first black mutant appeared in the Manchester region and by the end of the century 93 per cent of the population was melanin, camouflaged by the soot and sulphur dioxide, the latter being toxic to the

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Table 3. Death rates per 1,000. (Courtesy Mr A. R. Thatcher, Registrar General, OPCS.)

| Age     | 1876–1945 | 1961–80 | Reduction % |
|---------|-----------|---------|-------------|
| 85+     | 264.5     | 211.5   | 20          |
| 75-84   | 127.4     | 90.2    | 29          |
| 65-74   | 56.9      | 37.7    | 34          |
| 55-64   | 26.1      | 15.1    | 42          |
| 45-54   | 13.26     | 5.70    | 57          |
| 35-44   | 8.00      | 1.94    | 76          |
| 25-34   | 4.85      | 0.82    | 83          |

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Fig. 1. ‘Rectangularisation’: approximate survival curves. (Courtesy Mr A. R. Thatcher, Registrar General, OPCS.)
pale coloured lichens. In my home at West Kirby on the Wirral I have trapped the moth for 25 years and the proportion of the melanic form has dropped from 93 per cent to 61 per cent (Fig.2). The probable reason is the implementation of the Clean Air Acts in the 1960s and the moth is a good example of evolution in reverse[3].

Central heating

This is the same for both sexes and will not affect the sex ratio in old age, though it will certainly tend to keep old people in general alive longer.

'Urge'

The urge to reach the century in the very old may be strong, particularly in a cricket-loving country, just as conversely the bereavement syndrome, or the witchdoctor’s curse, may turn faces to the wall. Competitive urge certainly seems to have physical effects—beating the four-minute mile is a good example. On the other hand, racehorses bred for speed run no quicker than they did 50 years ago. Reverting to longevity, the decline in belief in an after-life may have increased the urge to keep alive in this one.

Eating and Weight Reduction

Diet is the modern craze and as regards longevity it receives support from animals. Rats live longer on a low calorie regime, and exercise, if begun in early life, also increases their lifespan. But rats are not men, and what about the higher animals? I wrote to two experts at the London Zoo and asked whether their mammals were living longer than 20 years ago; both said ‘yes’. The longevity improved once the keepers stopped the animals from having the public’s picnic scraps. What better indictment of human diet could you have? Interestingly, life appears to be equally prolonged for male and female mammals. Male animals, of course, have no retirement age. That really is the core of my argument. In man it is notoriously difficult to get reliable information on diet; no one can remember what they had for breakfast yesterday, but with golden weddings now ten a penny (provided couples stick together) it might be possible to get useful information between couples who know each other extremely well.

The Familial Component in Longevity

There is a general feeling among both laymen and doctors that a large component of longevity lies in one’s genes, and a number of papers[4-6] have been written on this theme, mainly from the Johns Hopkins Medical School.

These may be summarised by the statement that there are not specific genes for longevity but rather the absence of those that make for premature death, e.g. the sickling trait. Furthermore, all the papers emphasise the cultural factors in longevity, and although they do find that long-lived people tend to have long-lived relatives they are all somewhat equivocal as to the reason. No one, as far as I know, has carried out the proper survey to test the genetic hypothesis for polygenic inheritance. What should be done is to take male centenarians (the rarer sex) and look at their brothers and sisters and then do the same with women. Polygenic inheritance would be indicated if the males had longer-lived sibs than the females. It is the same type of work that C. O. Carter[7] did with hypertrophic pyloric stenosis. All the surveys that I have seen go vertically, and these are complicated by the fact that in looking at the age of the offspring of a centenarian there is his or her spouse to consider, which is confusing. The sibs have the same mother and father.

To try and clarify some of these points the RCP Research Unit is beginning an investigation with both the Royal Holloway and Bedford New College Sociology Unit and the Liverpool Institute for Ageing.

First, what sort of people are the very old? Are they mostly mentally feeble, stone deaf and just waiting for the end? Some are, and they need to be in institutions, but a great many are not, particularly if they can be looked after at home. My namesakes and their colleagues in Leicester[8] emphasise this particularly, and Dr John Harrison, on behalf of the College, has investigated residential care for people with severe physical disabilities. He is all for de-institutionalisation if possible, and he has an excellent quotation from Gerben De Jong which I have modified slightly: ‘The dignity of risk is what the movement for independent living is all about. Without the possibility of failure, the disabled person lacks the true independence that is the mark of one’s humanity—the right to choose for good or evil’.
In conclusion, I do not think that with the present environmental evidence we need to concern ourselves with the inheritance of longevity, except for the single gene diseases. There is so much that can be put right by paying attention to the environment. So away with testing people for those terrible apolipoproteins and let us concentrate on major factors such as diet, exercise, obesity and hypertension. If we do I think by the end of the century part of the College motto, 'life is short', will no longer be appropriate.

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References

1. Tyler, B. (1985) New England Journal of Medicine, 313, 957.
2. Lawther, P. J., Waller, R. E. and Henderson, Maureen (1970) Thorax, 25, 172.
3. Clarke, C. A., Mani, G. S. and Wynne, Goronwy (1985) Biological Journal of the Linnean Society, 26, 189.
4. Hawkins, Margaret R., Murphy, Edmond A. and Abbey, Helen (1965) Bulletin of the Johns Hopkins Hospital, 117, 24.
5. Abbott, Margaret H., Murphy, Edmond A., Bolling, David R. and Abbey, Helen (1974) The Johns Hopkins Medical Journal, 134, 1.
6. Abbott, Margaret H., Abbey, Helen, Bolling, David R. and Murphy, Edmond A. (1978) American Journal of Medical Genetics, 2, 105.
7. Carter, C. O. (1961) British Medical Bulletin, 17, 251.
8. Clarke, M., Clarke, Susan, Odell, Aileen and Jagger, Carol (1984) Health Trends, 16, 3.

Book Review

Practical Geriatric Medicine edited by A. N. Exton-Smith and M. E. Weksler. Churchill Livingstone, Edinburgh, 1985. 475 pages. Price £34.

Doctors in all branches of medicine (save those in paediatrics and obstetrics) now have to deal with an increasing number of elderly patients and this trend will continue for the rest of the century. It thus behoves all practising physicians to have some knowledge and skill in dealing with the elderly and differentiating disease from age if medical resources are to be used efficiently. This book aims to fill the gaps in the knowledge of 'Primary care physicians' (and hopefully surgeons) who may have had little formal training in geriatric medicine and for whom a major comprehensive textbook of gerontology would be inappropriate. The book is planned to be a practical geriatric cane muceum with a problem-orientated approach.

The multi-author text suffers from the advantages and disadvantages of being mid-Atlantic (29 authors from the Americas, 32 from the UK and Ireland and one from the Antipodes). For example, American enthusiasm provided chapters on 'Sleep disorders' and 'Gonadal function and sexual potency in aging men'. However, 15 pages are devoted to the former subject, compared with eight pages on 'Transient ischaemic attacks and stroke' and only six pages on the 'Acutely confused patient', and few British patients would have access to 'well-trained sleep specialists', polysomnographs or facilities for measuring penile blood pressure. The chapters on 'Diabetes' and 'Renal disease' give all blood glucose and serum creatinine values in mg/dl.

The book is divided into three parts. The first is a general introduction to the assessment of the elderly patient and outlines some of the functional changes that accompany the ageing process. There is a useful chapter on 'The evaluation of the elderly patient for surgery' and others deal with such problems as 'Cancer' and 'Infection' in its protein manifestations.

The main part of the book deals with specific systems such as 'Special sense organs and communication', 'Respiratory system' and 'Endocrine disorders'. Chapters within each section deal with selected common problems encountered in the elderly, for example 'Parkinsonism', 'Falls' and 'Hearing disorders'. The most useful parts of these chapters are those describing how illness in the aged differs from that seen in younger patients. Some information seems superfluous; all physicians will know the typical clinical presentation of myocardial infarction and the accompanying cardiac enzyme changes but it is helpful to have details of the atypical presentations of this condition in older patients. The chapter on 'Small bowel and pancreas' gives very practical advice as to likely causes of malabsorption in the elderly and the most expedient way of confirming the diagnosis. There is much useful guidance in these chapters but some of the advice is rather dated; few doctors would recommend subcutaneous insulin injection for diabetic coma.

The final part of the book deals with such topics as rehabilitation (not mentioned in the chapter on stroke) and public policy for the elderly. There is much of interest here but I wonder if the general reader (non-geriatrician) would delve deeply.

The core of this book contains much helpful guidance for the non-geriatrician on the care of his or her elderly patients, which would hopefully speed their return to the community and independent living.

G. M. WOOD