support for population genetic studies there is a real danger that human genetics could become the next biotechnology scare.

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Competing interests: JK has a Wellcome Trust studentship.

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A healthy old age: realistic or futile goal?

Marion E T McMurdo

The undreamed of improvements in average life expectancy in the 20th century have thrust ageing to the forefront of attention, and more old people are alive today than at any time in history. People over 60 currently constitute a fifth of the UK population and will constitute one third by 2030 (figure). Though increasing life expectancy is hailed by some as one of the greatest achievements of the 20th century, a more common reaction is a doom-laden prediction of health and social budgets being drained by caring for dependent old people. Indeed some have argued that directing resources away from old people can be justified.[1] Sensible debate about the impact of the changing age structure of the population has been hampered by media coverage edged with hysteria.

Of course, we need to consider how to care for the growing number of old people, but this aspect has dominated discussion to the virtual exclusion of a search for strategies which might improve their overall health. This negative tenor has been fuelled partly by a misunderstanding about health in old age. Certainly older people in general have poorer health than younger people, and this is due partly to the higher rates of disease in old age. The incidence of heart disease, for example, increases with age, but this does not mean that ageing itself is a cause of heart disease. Nor does it mean that heart disease is inevitable in old age. The crucial distinction between the effects of age alone and the effects of disease do need to be reinforced in the minds of both the public and health professionals. Finally laying to rest the pervasive misconception that all the ills of old age are "just your age" would represent a major breakthrough for health care of older people.

Distinguishing age from ill health

Setting aside ageism, some of the other fears about the increasing older population have their origins in the well established relationship between advanced age and dependency. This raises the important question of whether the overall health of the rising older population is improving or deteriorating.[2] The issue centres on the average age at onset of disability in relation to the average age at death. If potential exists to postpone the onset of disability this would result in a healthier older population, who would benefit from a shorter period of dependency before death. The alternative argument proposes that improvements in life expectancy have not resulted from better overall health but from the protracted survival of chronically ill and disabled people. In this scenario individuals face the unappealing prospect of an extended period of dependency in the years before death. This has been mooted as an argument against health promotion in old age, which some believe will simply increase the number of years spent in chronic disability.

However, evidence is beginning to emerge that, certainly for well educated, affluent older people, morbidity is already being compressed and that healthy ageing may be achievable for some. A landmark observational study from the University of Pennsylvania followed graduates from their early 40s to their mid 70s.[3] The study focused on the three potentially modifiable risk factors of cigarette smoking, body mass index, and exercise patterns. Those with high health risks from these factors in their mid-60s had both an earlier onset of disability and a greater level of cumulative disability, as well as more disability in the final year of life. In contrast, the age at onset of disability was postponed by more than five years in the low risk group. In this study, adopting low risk habits in later life was associated with not only an increase in lifespan but also an increase in healthspan.

The promise of healthy ageing resurfaced in recent longitudinal data on disability from the United States showing that its older population is less disabled and

Summary points

- Although older people have poorer health than younger people, ageing does not cause disease
- Older people with better health habits live healthier for longer
- Regular physical activity in old age can "rejuvenate" physical capacity by 10-15 years
- Research is needed on incentives and opportunities for older people to adopt a healthy lifestyle

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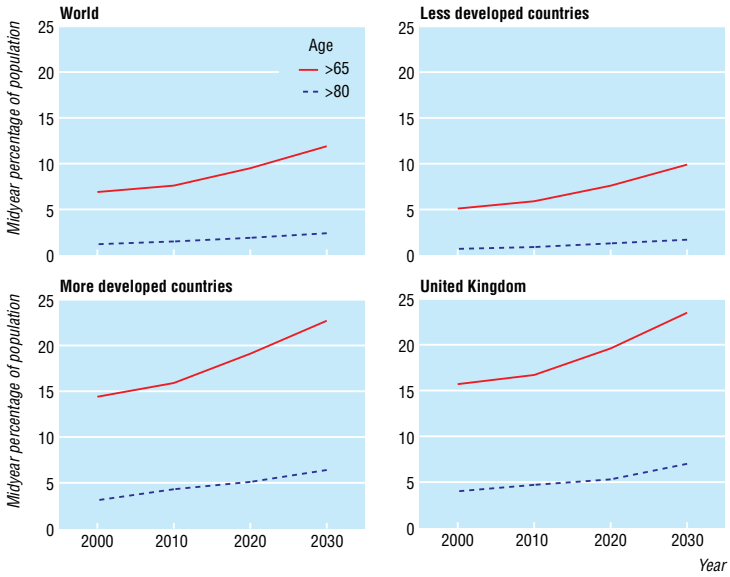

Growing proportions of older people are a world wide phenomenon. Data from US Census Bureau

less ill than predicted.[4] This unexpected finding may be due to a range of factors which include cohort effects, medical interventions, and healthier lifestyles.

Misconceptions about exercise

Although lifestyle issues should not be considered in complete isolation from each other, this article will focus on the influence of physical activity on health in old age. It is clear that regular physical activity—bodily movement that is produced by the contraction of skeletal muscle and that increases energy expended—is associated with a reduced risk of coronary heart disease, diabetes, cancer of the colon, and several other chronic diseases. Exercise, a subset of physical activity, may be defined as planned, structured, repetitive movement done with the express purpose of improving or maintaining physical fitness. Demonstrating that exercise can be beneficial is less difficult than persuading people to be more physically active.

PAUL DOYLE/PHOTOFUSION

Lost fitness can be regained with regular physical activity

Part of the problem is the common misconception that to reap health benefits, continuous, vigorous exercise (athletics, jogging, or squash) is required. This notion has its origins in studies of the effects of endurance exercise training on maximal oxygen uptake in younger adults. This work produced a physical fitness recommendation of 20 to 60 minutes of endurance exercise at 60% to 90% of maximal heart rate, three or more times a week. This advice was so scientific, complex, and prescriptive and set such an unattainable goal for sedentary and older people that many must have given up on exercise as a lost cause. However, a reassessment of the original evidence together with a growing body of new research has shown that most of the health benefits can be gained by performing regular moderate intensity physical activities (the equivalent of brisk walking at three to four miles per hour for most healthy adults) outside of formal exercise programmes.[5–7]

This good news for couch potatoes of all ages is particularly heartening for older people (who find it is much easier to adopt and maintain more modest activity levels) and it carries the added bonus that low to moderate intensity physical activities are more likely to be continued than high intensity activities.[8] It is therefore unfortunate that public health advice has failed to shake off the high tech lycra-clad image of aerobic exercise and physical fitness and instead embrace the broader concept of health and physical activity—walking, dancing, bowling, or gardening.[9]

The benefits of exercise

Physical capacity peaks in young adulthood and then declines progressively decade by decade at a rate which varies from one individual to another. Part of this physical decline is due to ageing and is not amenable to intervention. Even healthy ageing is associated with a striking loss of muscle mass and hence muscle strength: by the age of 80 about half of muscle mass has gone. However, some age related changes that were once thought to result solely from ageing are now known to be the result of disuse and are therefore potentially reversible.

The practical importance of this is that an older person is often precariously close to the threshold at which a small decline in physical capacity will render basic everyday activities, like rising from an armchair, impossible. The small added loss of fitness which occurs in association with an episode of intercurrent illness may render even a previously healthy 80 year old immobile and dependent. There is, however, substantial evidence that lost fitness can be regained with regular physical activity, even in extreme old age.[10]

Strength training does not halt the underlying loss of muscle fibres, but the improvements in strength reported in studies of exercise training in older people may be equivalent to 10 to 20 years of "rejuvenation" and may prevent an individual from falling beneath functionally important thresholds.[11 12]

Many other health benefits are associated with regular physical activity in old age. Weight bearing exercise may slow the rate of bone loss in older women; balance exercise training and tai chi may make falls less likely; and regular exercise may help in major depression.[13–15] The social benefits of group exercise

Physical activity

- Regular moderate intensity activity for 30 minutes on most days of the week benefits health
- Activity need not be continuous and may be accumulated in short bouts
- Physical activity levels are related to income and inversely related to age
- Older people who have long been sedentary should start slowly, beginning with a few minutes a day, and build up gradually
- If an activity is not provoking symptoms it is very unlikely to be doing harm
- For most older people the benefits of activity outweigh the risks
- Clinicians should be physically active, to benefit their own health and to add credibility to their advice

activities in later life should not be underestimated in a population where social isolation and loneliness may be common.

Challenging cultural expectations

Clearly there are compelling reasons for old people to be physically active. However, if more old people are to have this opportunity, radical changes in attitude are required. Prevailing cultural expectations that pensioners should "put their feet up" must be challenged. The literature on exercise trials in old age is remarkable for its paucity of adverse events. If an activity is not provoking symptoms it is very unlikely to be doing harm. Well intentioned relatives who take over the household chores may be depriving their elderly relative of their main physical activity of the week. Too often the old person struggling with an aspect of self care in the community is simply provided with social support, when a more appropriate response might be treatment to help regain the lost skill.

The provision of inappropriate social services to old people may simply accelerate the rate at which physical abilities are lost, and low staffing levels in hospitals and homes are likely to create unnecessary dependence because pressure of time means that it is faster for staff to perform a task for the patient than to allow the person to perform it for himself or herself.[16]

There are no guarantees about health. A healthy old age depends heavily on luck and genetic and other factors that are not amenable to intervention. Nevertheless, lifestyle factors in later life are crucial influences on healthspan and disability and are potentially modifiable.[17] Additional disability free years in later life are precious to individuals and to society, but this prospect should not be overestimated. Disability may be postponed; it will not be eliminated. Old people will still require long term care and many of the chronic disabling diseases of later life will still take their toll.[18]

Unfortunately health issues in old age are neglected by most health education campaigns. Older people require access to information about healthy lifestyles, the ability to appraise such information, and a sense of control over their own future. It is also important to understand more about how and when such knowledge actually influences health behaviours: research is required into incentives and opportunities which would motivate older people to adopt and maintain healthy lifestyles. Such changes are less likely to be achieved by exercise prescription schemes[19] than by turning our environment into a more attractive place in which to be physically active, with attention to personal safety, good street lighting, and town planning.

The ageing of the population is a success story, and although much debate has so far focused on how to care for the growing number of old people an equally important target is how to maintain their health and minimise disability. A public health approach to an ageing society is long overdue.

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Competing interest: METM is codirector of DD Developments, a University of Dundee company with a mission to provide exercise classes for older people and whose profits support research into ageing and health.

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Endpiece

Proper use of science

Unharnessed instinct, of course, can present great dangers, but the proper use of science is to channel and train the instinct and thereby enable it to blossom with ever greater certainty—not kill it off.

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