

The fountain of age:

A viewpoint

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This edition of *NZFP* is dedicated to the care of older people. I write to set the scene for this issue with a viewpoint on ageing. The case of the older person is well worth considering in the broadest sense in the 21st century. There will be many more people of the oldest old age groups within the next decades. Their contributions to society in general and influence on patterns of medical care utilisation as well as their needs for informal support with attendant stresses will be felt during our working lives.

This is not a comprehensive review of the biology of ageing, rather a cursory overview of why and how we may be ageing. For the biological perspectives I rely heavily on the works of Tom Kirkwood, Gerontologist from the University of Newcastle and it should be noted that there are several theoretical stances and I do not pretend to present a balanced view. Further reading will be needed to gain a comprehensive perspective of all areas. These theories are followed by what we know of how to age

'successfully' both from a biological and a physiological sense and finally we consider the plight of the New Zealand GP facing a ballooning in numbers of older patients. What are we really spending our time on and could our efforts be refocused to better serve this emerging fountain of age in future years?

How are we ageing?

The New Zealand population is ageing, but the oldest old are the fastest growing population group of all. Between 2001 and 2051, the percentage of the New Zealand population aged 65 and over is expected to grow from 12% to 25% of the population.¹ This is a rebalancing of the age groups as there is just as much of a decrease in the youngest ages as an increase in the oldest. Nevertheless people over age 85 years are the fastest growing population group in New Zealand with a projected increase from 1.3% of the population currently to 6.0% of the population by 2050. Life expectancy has increased by over 10 years in the last 50 years and is projected to increase a further five to six years by 2050. Despite advanced age and increasing frailty and co-morbidities, the majority of those over age 85 years

are living independently in the community, one half with spouses and one half on their own.² While relatively little is known about this age group, expenditure on personal health and disability support is the highest for any age group with

a yearly per capita spend of \$13,640 for women and \$12,144 for men.² This group also has the highest rate of preventable, ambulatory sensitive and unavoidable hospitalisations of any age group.³ Small influences in health for this age group could potentially lead to larger savings and benefits to quality of life.

While most older people live independently in the community, only 15% of people 85 plus live independent of service provision; 36% of people 75 plus have a moderate disability and 18% a severe disability.² The accumulation of age related changes in physiological functions and the development of disease processes lead to high levels of co-morbidity, loss of autonomy and development of dependence among very old people. The increase in longevity over the last half century has not necessarily led to a lengthening of active life. Our society remains essentially ageist, diverting resources and attention to the young and vibrant. We, as doctors, are just products of our upbringing and are no stranger to these views. Some doctors feel quite nihilistic towards promoting health for older people.⁴ While there is a general understanding that the physiological and functional age are better markers of well-being and disability, the health system is generally against offering intervention to those of advanced chronological age. As advocates for our patients we will be dealing with this more and more in the years to come. Appropriate use of health services with respect to advancing age is a debate that society must revisit again and again throughout this fountain of age.⁵

There is no doubt that survival is increasing but there is debate about whether the potential absolute years of life to be lived are constrained by some fixed amount. Figure 1 shows schematically how the survival curve has altered in the last century. Will the curve move to the right lock

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stock and barrel, or is there a fixed point on the x (age) axis that cannot be surpassed? It is worthwhile taking a look at some of the recent theories about ageing to help think about what the future holds.

Why do we age?

While it is inevitable that we age, from a biological sense, ageing is not necessarily inevitable. Animals only age in captivity as most perish early in life and, from an evolutionary perspective, surviving only to reproductive success is important. All subgroups of humans age but there is a large variation in the rate and successfulness with which they do it. A population-based study of the genetic make up of the whole of Iceland has shown that our genes predict about 25% of our life span. A combination of nature, nurture and chance decides the rest of our longevity.⁶ Currently, however, humans are surviving much longer than they need to and why this is a matter of ongoing debate.

Theories of why we age have included the thought that we were somehow programmed to switch off at around 100 years, that there was a 'death gene' of part of a gene that switched itself on. This has largely been shown to be less likely to be true. The longest lived person in the world died at the age of 122 and there is at least some evidence that the whole curve in Figure 1 is moving to the right, rather than rotating around a fixed maximum point on the age axis. There is no active mechanism to destroy our complex organism.⁷ It makes more sense to think of a weakness in our genes that do us good, rather than the existence of genes that do us harm. We fail to stay young, rather than actively age.

Ageing most probably happens because of the continuous bombardment of our chromosomes by free radicals, especially the telomeres at the end of the DNA helix that assist in cell division. This causes ongoing

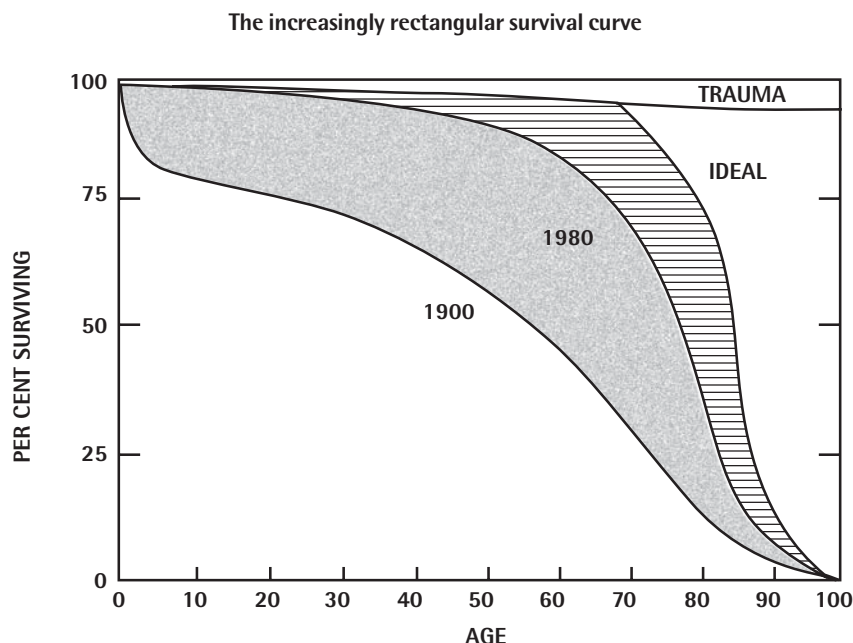
areas of damage that accumulate and interfere with cellular processes leading to physiological change and eventually an impact on the whole organism. The number of hits from free radicals to our DNA is astronomical, with probably 10 000 hits per cell per day. While there is an efficient process of repair and maintenance of the damage happening to DNA on an hourly basis, persistent areas of damage are copied on to the next cell, and recopied, and recopied like a photocopier.⁶ Try photocopying a page, copying the copy, copying the copy again and again 100 times (some cells divide many more times than this). It gets very tatty and it is easy to imagine how cellular processes, protein production, and all those other things that our genome controls, can be disrupted. This is expressed both as the physiological changes associated with ageing (decrease in most physiological parameters) and the development of diseases. The spectrum of disability seen in older people is contributed equally by disease and development of age related frailty.

The largest contributor to the continuous bombardment of our cells is oxygen free radicals. Smoking and sunlight exposure are other sources of cellular damage that can be avoidable. The maintenance and repair mechanisms of the body are active and efficient and repair much of the damage. This process is expensive however, and a balance of activities must be undertaken to ensure survival of the species. Evidence to support this theory is that long-lived species have higher levels of markers of maintenance and repair processes than short-lived species.⁷ Where the energies of these maintenance and repair processes are focussed decides what areas of our complex organism are affected over time.

Does sex shorten life?

Aristotle believed that sex shortened life. Biologists now believe it is the

Figure 1. A schematic representations of survival statistics from birth to 100 years comparing 1900 with 1980 and a hypothetical ideal survival curve.



About 80 per cent (stippled area) of the difference between the 1900 curve and the ideal curve (stippled area plus hatched area) had been eliminated by 1980. Trauma is now the dominant cause of death early in life.

type of reproduction humans undergo, rather than the act of sex itself, that shortens our species' life. Other species whose reproduction uses vegetative processes have longer cell life. While this is interesting, humans are stuck with their very complex organism developed from two cell lines: the germ cell line leading to development of the ovary and testes and capacity for reproduction, and the somatic cell lines, responsible for everything else. From a biological and evolutionary perspective the somatic cells only need to be maintained until successful reproduction is likely. This series of biological evidence has led to the 'disposable soma theory'. The germ cells are maintained and repaired at a much higher level at the expense of the somatic cells.⁸ In fact it is problems with processes contributed to by somatic cells that lead to much of the morbidity that we see as associated with ageing. As far as sex goes, the only evidence that having sex itself shortens life is that in a study of the aristocrats' records in Europe. Above average fertility was associated with below average longevity.⁸ Apart from that there may be a small amount of evidence that an active sex life actually promotes healthy ageing, a much more palatable piece of information.

Men and women have quite different life expectancies. This difference in ability to survive is observed even from before birth. The simplest way to explain this difference is to say that castration equalises longevity. Fortunately this statement comes from studies of domesticated animals but there is much written about the influence of the sex hormones on ageing in both men and women. It is intriguing to consider why humans have evolved to support the survival of women past the reproductive age. Anomalous female survival after menopause has been in existence since pre-modern times and humans are the only species with survival beyond reproductive potential.⁹ As the human species evolved, the most striking change, in com-

parison with other species, is a large increase in brain size which led to social and cultural integration, the development of complex processes, language and the ability to manipulate the environment. The down side of this, however, is the fact that babies heads got too large to easily fit through the birth canal, which was simultaneously evolving to support upright stature. As a result, human babies are born relatively prematurely. Most animal offspring are ready to take flight with their parents within a few days of birth and can actively feed themselves within a few hours.

The human brain is not completely developed at birth and cannot support independent survival. Grandmothers are thought to be the answer to this dilemma of evolutionary success and resulting reproductive mess. To limit fertility to younger age and to provide support from grandmothers enhanced the reproductive success of daughters by relieving them of dependent offspring. This may have resulted in fewer orphans, greater survival to adult age and, relatively speaking, greater success of the species. This theory is supported by anthropological studies documenting passing on of essential wisdom from grandmothers to infants. This wisdom was information about success in food gathering and other aspects that promote survival in less developed societies.⁸ It is also supported more locally by a study of rural women GPs. Those with a mother in the same town were happier, healthier and more able to successfully complete their work.¹⁰

How do we age successfully?

Regardless of why or how we age and how interesting all that is, whether we can age more successfully is a topic of worldwide debate.

General practice is driven by the patient and, without a systematic approach to emphasise health gain, all time could be used on reacting to chronic problems

If we can, then the impact of the approaching waves of older people on health services may be, to some degree, ameliorated. More importantly the well-being of the older population will be improved. Predictors of health and long life include medical, non-medical, societal, physiological and psychological factors. From the perspective of the older person, the ability to choose and

keep on choosing can be seen as successful ageing. Maintaining autonomy is related to health, reduction in dependence and an increase in psychological well-being. The choices we make may also amelio-

rate ageing, as 75% of ageing is thought to be attributable to non-genetic factors. The variability that is seen in the way different societies age is substantial. For example, Japanese living in Japan are the longest lived of any nation. Rates of cardiovascular death are about 100 per 100 000 of the population in the age group 64 to 74 years. In contrast Americans die at a rate six times this, 600 per 100 000. When Japanese move to the USA, however, by the second generation their rate of mortality from cardiovascular disease has risen to the level of the US population.

The societal level influences on lifestyle may act through many mechanisms. The biologists argue that there are molecular explanations. The influence on individual choice about lifestyle issues from societal pressure will affect ageing. Environmental impact of exposure to damaging substances and nutrition and exercise patterns all vary according to cultural and economic factors. Understanding the mechanisms by which lifestyle choices impact on ageing may enable us to be more effective in influencing the choices that our patients make.

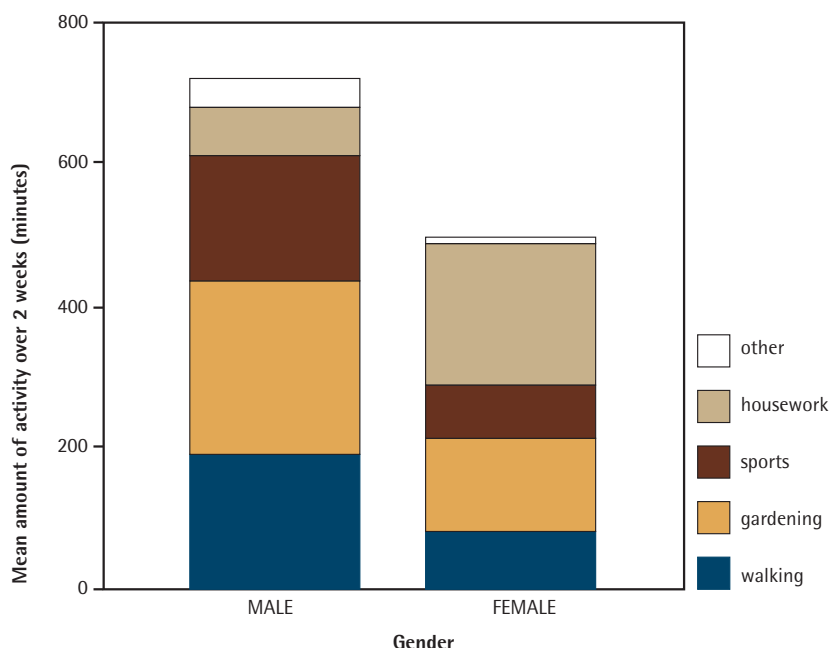
Nutrition

It seems that the old fashioned balanced diet provides all the components that are needed for successful ageing and ameliorating the accumulation of molecular damage caused by ongoing bombardment with free radicals. Trace elements and vitamins are needed for normal cellular processes, especially for the processes of repair and maintenance. Vitamin C in particular is an efficient moppper upper of free radicals, however, substantial wholesale suppression of free radicals may be bad.⁶ In worms that have less than 1000 somatic cells, which never divide, anti-oxidant drugs prolong life.¹¹ The human body is much more complex, with many organs and tissues in constant cell renewal. Free radicals are used by normal processes in BP regulation, the immune system and many other cellular functions. In Downs syndrome, an extra copy of the gene for superoxide dismutase (which gets rid of free radicals) on the extra chromosome 21 results in an imbalance in the antioxidant defences and has been implicated in cell harm and premature ageing. So the situation is complex to say the least.

Although nutritional supplementation ameliorating ageing is difficult to prove, evidence is growing that there may be some important aspects of nutrition that directly influence ageing. Most studies have been conducted in homogenous and non-representative groups and the confounding of other factors can easily explain successful results. Malnourishing rats increases their life span. There are no studies in humans supporting this, mostly due to the impossibility of such a study, however, observational evidence supports an association between lower weight and longer life.

Certain substances including Omega 3 fatty acids, Vitamin E, C, B6, B12 and folate may prevent the development of Alzheimer's disease through influences within the amyloid protein metabolism pathway. Curcumin, in tumeric, is also an ac-

Figure 2. Activity patterns in older Australians¹³



tive moppper upper of free radicals and influences the accumulation of amyloid. All of these are readily available in the normal balanced diet containing plenty of fruit and green vegetables.

New research with fruitflies has shown that a genetic mutation, the Indy mutation (stands for 'I'm not dead yet', fruitfly geneticists have linguistic abilities also it seems), results in a doubling of life span. Usually, organisms put surplus energy away for harder times as fat. Indy mutants have altered energy metabolism and may use this 'rainy day' aliquot for repair and maintenance of cells. Mutants don't survive in the wild because the rainy day storage function is necessary, but there may be new insights about the value of energy metabolism to ageing that will have clinical relevance.

At a more practical level, maintaining adequate nutrition for isolated older people is difficult and this is a cause of weight loss, osteopenia and other disorders. Support for shopping, access to desirable food groups and a social environment in which to eat are all important for maintaining nutrition.

Exercise

Adequate physical activity for health is essential to well-being, especially for the very old. This has been proven for decades but still a minority of older people undertake adequate regular activity. Sedentary lifestyles are unnatural for humans as we were built for long range scavenging and occasional extremely vigorous activity, so it is not surprising that sitting all day is bad for us. Gradually older people reduce their amount of habitual activity¹² and, eventually, many older people are at the limit of their physical capabilities simply completing their usual activities of daily living. Figure 2 shows the breakdown of habitual activity of a group of general practice patients over age 65 years. This group were patients of GPs who undertook a practice assessment and educational programme about health promotion for older people.¹³ Housework, gardening and walking make up the bulk of all activities. As the household reduces in size, these activities are lost and habitual patterns are likely to be even further reduced in the future decades. How many of the current crop of 40–50-year-olds

have a large garden or participate in housework on a regular basis? Those who live in houses with stairs live longer¹⁴ but as transitions associated with ageing usually mean accommodation that is easier to care for, the available usual activity is constrained. Older people are just as able to increase their activity as younger people. A simple educational programme completed by GPs resulted in an increase in activity of as much as 20 minutes per week in Australia and 45 minutes when the green prescription was used in a systematic way.^{13,15} What is intriguing is that the GPs whose patients had the greatest increase in activity were unaware that they had had a positive impact and, in fact, they had not liked the educational programme.¹⁶ GPs do good work at promoting health for older people, even though they may be unaware of their success.

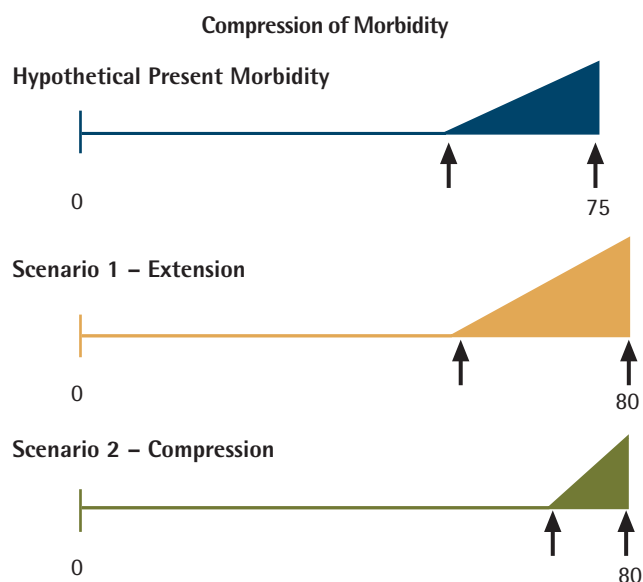
The benefit of activity to physical and psychological health is well proven¹⁷ but it remains to be seen how best to activate the whole population in a sustainable way. While there are many physiological mechanisms to explain the positive effects of activity on ageing, at a cellular level it is seen that those who undertake exercise have less damage to somatic cells and fewer mitochondrial mutations.⁶

Disability

Throughout the world 290 577 814 people in the year 2000 required some form of daily care. This number is projected to rise to 612 888 500 people in 2050.¹⁸ While the majority of these will be in the third world and developing countries, if we are unable to impact the trajectory of development of disability, the increase in absolute numbers of older people requiring daily care will put undue strain on the capacity of community support service providers and primary care, especially if ageing in place is taken literally.²

Disability is influenced by both physical and psychological factors

Figure 3. A schematic representation of the hypothetical potential expression of disability free survival (the flat line section of the graphs) as the population ages.



The future of population health is dependent upon relative movement of the two arrows, the first representing the average age of initial onset of disease or infirmity and the second representing average age at death. If the first moves more rapidly than the second, there is compression of morbidity.

and can be prevented with intensive physical activity.¹⁹ Mental health disability exceeds disability from medical problems^{20,21} and new ways to improve outcomes are needed. There is good evidence that the downward spiral of depression, leading to disability, leading to depression, can be interrupted with activity. Every effort to activate older people to increase habitual activity will have a benefit in the long-term. Figure 3 shows a schematic representation of the concept of compression of morbidity as life extends, rather than prolongation of the disabled years. We all aim for scenario 2, however evidence that this is what is actually happening is scarce.

Alcohol overuse and smoking

No discussion of successful ageing is complete without a mention of the harmful effects of these lifestyle behaviours. Smoking directly increases free radical production, increasing cellular damage. The macro level harmful effects of tobacco smoking are well documented and

GPs are very effective in encouraging older people towards smoking reduction.²² Alcohol overuse is also amenable to brief interventions in primary care.²³

General practice, older people and the 21st century

While our genes control 25% of our longevity, and lifestyle behaviours and socioeconomic and societal factors have an influence, recent evidence from the longitudinal studies of ageing suggests that social connections and support play a large role in predicting well-being.²⁴ The biological mechanism for this cannot currently be explained.

Good medical care, primary health care in particular also influences successful ageing. The recent National Survey of Primary Medical Care (NatMedCa) forms a good basis for looking at the patterns of utilisation in general practice. What are we spending our time on and can this be related to the relative areas that could most have an influence on ageing?

Our patients over age 65 years attend frequently, an average of five times a year. Less than 10% of all older people do not attend a GP in any one year. Those over age 65 make up 12% of the population, however they make up 22% of the consultations in general practice.²⁵ This means that women over age 75 years consult 2.29 times as often as one would expect, considering the proportion of the population they make up. For Maori providers, however, older people make up a lesser proportion of all consultations (15.6%),²⁶ in fact older patients are under-represented at Maori providers' surgeries.

The most common problems managed by GPs for older people are (in order of frequency): cardiovascular (almost 40% of all consultations with older people), respiratory, musculoskeletal (about 15% of all consultations), skin and cutaneous,

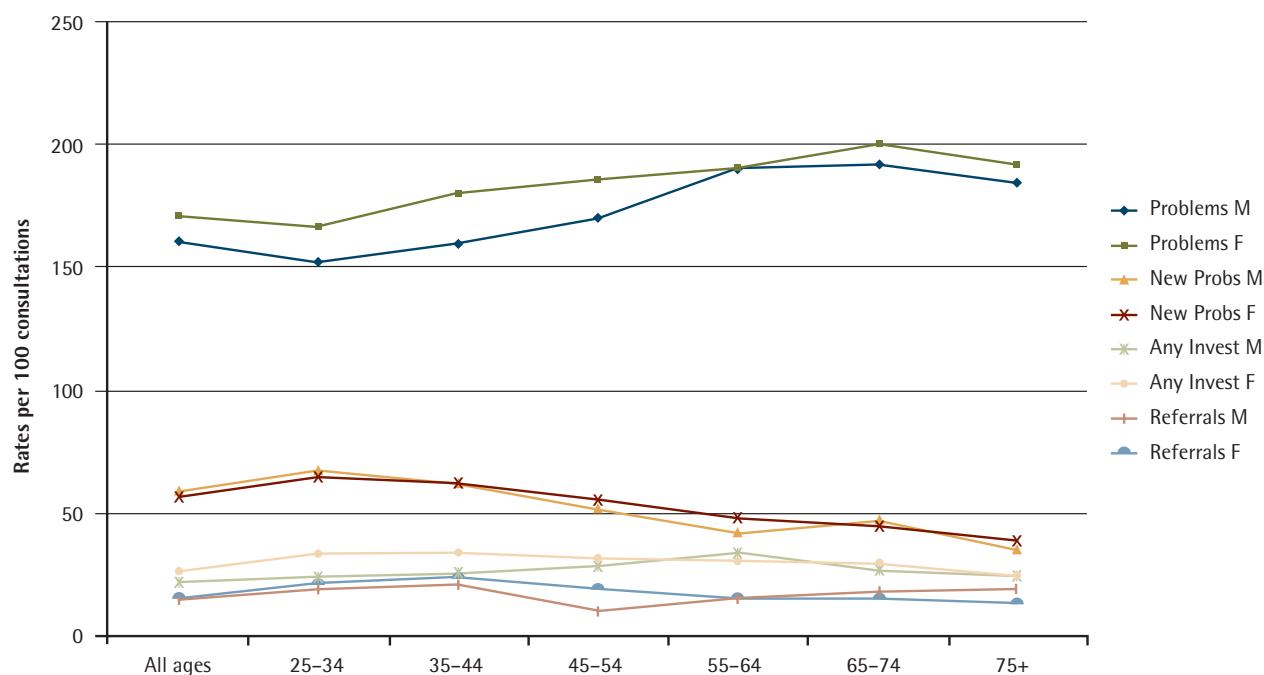
injury and poisoning, digestive, cancers and neoplasms, endocrine and metabolic, nervous and sensory organs, mental and genitourinary (about 10% of consultations).²⁵ This list suggests a mix of chronic conditions and acute problems and differs from the order of the top 12 problems for younger people, in that musculoskeletal and cancer related problems are more frequent in the oldest age groups. A similar survey in Australia, during the same time period, showed remarkably similar results with both the frequency and type of problem managed in these age groups being similar.²⁷

The number of problems managed at each consultation increases with age, peaking at about two for those aged 65–74. This number falls slightly to about 1.9 problems, on average, per consultation for those over age 75 years. New problems are

only present in about 36–40% of consultations with older people. This contrasts with 63% of consultations with those aged 35–44 being about a new problem.²⁵ This confirms that currently chronic or known problems dominate consultations with older patients.

Referral patterns and investigations as a result of consultations are fairly steady throughout the lifespan (see Figure 4) and the rate of prescription writing is actually slightly less in the oldest age group (70 per 100 visits for those over age 75 years compared with 72–78 per 100 visits for those aged 65–74 years). The number of items is much higher, however, with the average being 168 (women) and 174 (men) script items given per 100 visits. The most frequently prescribed item for older people (found in more than 50% of consultations) is, not surprisingly,

Figure 4. Number of problems identified and management issues reported in general practice care of older people in New Zealand 2000/02.



M = Male

F = Female

Probs = problems

Invest = investigation including radiology

Referrals can be medical or non medical.

cardiovascular drugs, followed by nervous system drugs, including analgesics and blood and anti-thrombotic drugs (including aspirin).²⁵ Patterns of drug prescribing in Australian practice differ from New Zealand patterns with Australian patients receiving fewer cardiovascular drugs overall and more antibiotics and drugs for psychological problems.²⁷

Older people also are less likely to attend other providers, the A&E or A&M clinics for acute medical care than GPs. The mean age of GPs' patients was greater, and that of A&M patients lower, than that of ED patients.²⁸

Even though more chronic problems and more problems per visit are managed in general practice, visit times for older people appear to be shorter, a mean 15.9 minutes compared with 17 minutes for those aged 45–64. The only group with a shorter consulting time is that under 25 years (mostly children). These consultation times are even shorter in rural areas with a mean of 14.5 minutes. The mean severity of problems was, however, higher for those over age 65 years. Level of uncertainty in diagnoses made was slightly higher for rural practitioners dealing with older patients.²⁹ This is in contrast to the Australian study where length of consultation increased in the older age groups.³⁰

It is interesting that the 55–64 year age groups appear to be high users of primary health care and one wonders what the next decade will bring. The middle age groups also had high levels of psychological morbidity in the primary mental health

survey (MaGPIe) signalling that mental health issue may become more important as these cohorts reach older ages.

General practice and active ageing

The NatMedCa study describes activities in general practice delivered to older people as mainly concentrating on management of known problems, with cardiovascular disease and prescribing for this being prominent. It is surprising that consultation time is shorter for older people and that referrals and non-medical treatments are relatively low. It is not easy to see, from the reports of the NatMedCa study, whether GPs are spending time on activities that are likely to influence the ageing process. General practice is driven by the patient and, without a systematic approach to emphasise health gain, all time could be used on reacting to chronic problems and the opportunity to emphasise nutrition, physical activity and other potentially health-giving activities lost.

If the pattern of consultations remains constant, the doubling of this population group will result in an increase in the proportion of consultations for those over 65 years to almost 50% of consultations. The corresponding necessary workforce expansion will be considerable and upskilling about the care of older people should be part of routine CME events. Prevention of cellular damage is relevant throughout the life span and healthy living could be a more common topic of conversation within the consulting room.

In conclusion

The fascinating topic of the biology of ageing can help GPs understand the spectrum of disease and disability presented by older people. Declining cellular repair and maintenance mechanisms and ongoing cellular damage from the stings and harrows of life in the 21st century most probably cause ageing. Currently there is no miracle cure, but a combination of good nutrition, physical activity, good social support and maintaining a positive outlook on life may ameliorate ageing.

Looking after grandmothers may benefit the species as a whole and while castration may not be an option to equalise longevity between the genders, older men do undertake more activity on a habitual basis (except for housework of course) but are as amenable to health promotion interventions as women.

The ability to choose and to maintain autonomy is essential to well-being in old age and our society has a role in promoting positivity in ageing. Ageist attitudes and thoughtless policies impact societal views and these can be addressed at all levels, including the daily practices of GPs.

The NatMedCa survey does not specifically tell us how much emphasis GPs are putting on healthy ageing within the many consultations they have with older people. Undoubtedly more could be done. It is reassuring that GPs are very effective in assisting older people change behaviour and they should be reminded that when an emphasis is put on a health issue within the consultation, health benefits are likely to follow.

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