CSIRO Submission
to the

Inquiry into long-term strategies to address the ageing of the Australian population over the next 40 years

Terms of Reference

The House of Representatives Standing Committee on Ageing will inquire into and report on long term strategies to address the ageing of the Australian population over the next 40 years.

Introduction

The Intergenerational Report identified issues of concern to the Government which include projections for:

- An Australian population of over 25 million by 2042, an increase of over 30 per cent
- A life expectancy at birth for men of 82.5 years and for women of 87.5 years by 2042
- Growth in the number of people aged 55 and over faster than in the number aged under 55
- Increased spending on health and aged care, due to an increase in the number of people over 65 and an even greater increase in the number over 85

This is taking place in an environment within which Commonwealth health spending has already more than doubled over the past three decades, to 4.0 % of GDP in 2001-02.

- Spending on the PBS has been the fastest growing component of this increase, doubling as a percentage of GDP over the last decade.

The ageing population raises a number of issues that the government will need to address, including:

- Maintaining and improving the quality of life for the whole population
- Meeting health care costs and preferably reducing them without reducing the level of service
- Coping with a situation in which an increasing proportion of the population will not be part of the workforce
- Providing a high level and quality of aged care services given the increased demand and a proportionately smaller workforce to provide and pay for these services.

Among other things, the intergenerational report notes the importance of:

- Achieving budget balance which requires strong economic growth, industrial developments, improvements in productivity and increased exports
- Maintaining an efficient and effective health care system
- Containing growth in the Pharmaceutical Benefits Scheme (PBS)
- Encouraging mature age participation in the workforce
- Affordable and effective residential care

Fortunately, the ageing of the Australian population will not have a significant effect on the budget for 15 years. This allows time to respond to the shifting demographic by planning and implementing a strategic, coordinated and holistic response. Research in both Science, Engineering & Technology and Social Sciences & Humanities can make a significant contribution to this response, if we start now.

The challenge posed by the ageing population can be looked upon as an opportunity - an opportunity for large scale innovation and multidisciplinary approaches which have never been used before to develop direct outcomes of benefit to the wider population. The issues around an ageing population are embedded in the present population structure, which will evolve over the next 40 years. Existing research strategies are already addressing relevant issues but there will be new opportunities to develop solutions to specific needs using multidisciplinary skills in areas such as better communication systems, biosensing, and telemedicine which will enable services to extend to remote and regional Australia.

As Australia's largest research organisation, CSIRO can help in defining some of the issues and by conducting research to address them. Indeed, over recent years CSIRO has worked hard to identify issues of national importance and to see how it can best provide the concentrated effort necessary to tackle them. Many of the issues CSIRO has identified deal with matters of direct interest to the Standing Committee on Ageing's inquiry.

CSIRO is well positioned to deliver for the government on these and other issues by using multidisciplinary teams working in partnership with other organisations to deliver scientific solutions to advance Australia's most important objectives:

- Strong, sustained economic growth: new industries, enterprises and jobs
- Clean water, cost-efficient energy
- A sustainable society that fully re-uses waste

- Longer, healthier, more productive lives for Australians
- Cutting edge communications and services
- Improved security, safety and defence
- Growth and prosperity for regional Australia

Research in CSIRO brings together leading scientists, institutions and industry participants from across the nation in a true "Team Australia" approach to perform national benefit science promoting economic development, international competitiveness, and improved productivity – all of which are necessary to ensure that if the working population becomes a smaller proportion of the total population, we can still maintain everyone's lifestyle and quality of life. In this sense all of CSIRO's work, whether directed to improving industry competitiveness or to improving our environment, will help make it easier to cope with an ageing population.

A more specific example of CSIRO's direct contribution to aging issues is that our preventative health research provides a direct and cost effective response to many of the concerns that result from an ageing population. Preventative strategies provide benefits across the whole of a person's life span – not just at the end – and they should apply right through a person's life to have the maximum benefit.

In the past, technological developments have contributed to the blow out in health costs, for example because of the cost of new drugs, or of more sophisticated and expensive equipment and interventions. However, the focus of most previous work has been on intervening after the problem has already occurred. Turning to a preventative strategy from a curative one has the potential to reduce costs while improving the quality of life and reducing the incidence of problems that occur over the ages a person participates in the economically active workforce. .

Background to Preventative Health

Increasing longevity, diverse lifestyle choices, and psychological pressure are increasing the cost of healthcare. The Intergenerational Report recognises these issues and this Inquiry indicates that as a matter of urgency Australia must address its own health care issues in relation to the ageing population. New technologies that will enable major advances in preventative health and management of disease predisposition are emerging, and consequently preventative health measures are poised to assume new commercial and public health dimensions.

Among the most important recent advances in health care technology are radical improvements in the ability to detect disease states at an early stage, combined with increasing understanding of the factors both internal (genetic) and external (environment, nutrition etc) that lead to disease. Together these scientific advances are making predisposition and susceptibility analyses central elements in healthcare management, leading to opportunities to prevent or ameliorate disease through strategies based on customised staged nutritional programs, lifestyle changes and therapeutics.

Among the more widespread and socially significant of the diseases whose incidence can be alleviated by preventative strategies and which either relate to increased incidence as the

population ages or, may reduce the burden of disease in older age if prevented in the younger age groups, are:

- Long-term incubation diseases of the elderly, such as osteoporosis, dementia, osteoarthritis, cardiovascular disease and multiple forms of cancer.
- Diseases associated with development and adolescence, many of which are showing disturbing increases in incidence, such as asthma, Type 1 diabetes, inflammatory diseases (bowel, arthritis) and mental illness.
- Clearly inherited diseases, often caused by mutations in one or more genes and/or through the interaction of genes with the environment in early childhood.
- Diseases caused or exacerbated by particular environmental or lifestyle conditions including building materials, air quality, electronic disturbance, nutrition and physical activity.

In addition, injuries that may or may not be related to underlying disease result in a significant burden. Such injuries include falls, accidents and suicide attempts. Infectious pathogens in the food and water supply chains and general environment have the potential to create a major burden of disease. While such diseases have a relatively small impact, a defensive capability is essential in the event of infrequent or adventitious outbreaks.

Preventative health provides the opportunity for considerable savings in healthcare expenditure in addition to the human benefits from improved health outcomes. It is widely accepted that mounting pressures on healthcare resources threaten to raise the proportion of Australia's income devoted to healthcare from its present level of 4% of GDP, and that such increases threaten the sustainability of a publicly-funded system based on equity of access. There is a considerable body of evidence to show the economic benefits of effective public initiatives for the prevention or early diagnosis of many diseases, including infectious disease, cancer, dental caries, and cardiovascular disease.

There are very few fully costed estimates for the value of prevention or delayed death in the Australian context. One way of illustrating the impact is to estimate the value of delaying the deaths in the age group 35 – 65 by 10 years. Using US estimates of the total age adjusted value of life (Murphy/Topel, cited by Lasker 2001), corrected for relative national wealth and exchange rates, reveals that a 10-year delay in death in Australia would have an economic impact of A$74 billion or $7.4 billion per year delayed. It is likely that continued reduction in cardiovascular disease could be a significant contributor to such a scenario.

Direct savings in healthcare expenditure on acute treatment and disability management would be very large but outweighed by the much greater economic contribution of people living longer, healthier lives. A recent US study, *"Exceptional Returns: The Economic Value Of America's Investment in Medical Research"*, argues that increases in life expectancy between 1970 and 1990 were worth US$57 trillion to Americans. Adjusting for population and GDP differences, the comparable figure for Australia would be over A$5 trillion for the 20-year period. Similar analysis suggests that a 20% reduction in cancer would be worth A$1 trillion.

A clear example of the impact of prevention is provided by cardiovascular disease. Deaths from this cause peaked in 1968 and have declined by more than 60%. Much of the decline has been due to market-led dietary change including types of fat consumed, and illustrates a

relatively short time lag for results. It is estimated that 80% of Australian adults still have one modifiable risk factor. More than 20% of the population over 18 has a cardiovascular condition. A further reduction in cardiovascular disease by one third could reduce direct healthcare costs by more than $1.2 billion per year.

The increasing burden from neurodegenerative diseases raises serious concerns.

> *As life expectancy continues to increase, the burden of degenerative disease is growing. Developing effective means of preventing these disorders and of treating them when they do occur is a paramount challenge. The problems caused by Alzheimer's disease and Parkinson's disease are already so great that if the prevalence of these maladies continues to increase in accordance with the changing demographic characteristics of the world population, they will bankrupt both developed and developing countries over the next 50 years. (Prusiner 2001)*

Dementia alone costs $1 billion in direct health costs. At least 10% of people aged 65 suffer from dementia with Alzheimer's Disease being the leading (more than 60%) condition. Importantly, around 50% of people diagnosed are classified as having moderate dementia at their first clinical visit – i.e. early onset is missed.

At the other end of the demographic spectrum there are considerable opportunities for reducing the health burden among the 12-24 year age group. The majority of disability-adjusted life years lost is due to mental disorders. In this age group 10% of females and 3% of males have a depressive disorder. Suicide is very high among males and females show high levels of eating disorders. In addition 16% suffer from asthma. The 3,300 "youth" lives lost represent approx. $15 billion economic loss per year for this age group. The loss from a poor start to adult life and subsequent events has not been quantitated but would be a major loss of opportunity. There are significant opportunities for an impact from preventative measures.

Colorectal cancer provides another example of the potential for prevention. In Australia there are more than 10,000 new cases per year with death rates at 29.7 per 100,000 males and 19.6 per 100,000 females. Total lifetime risk is 1 in 21, with lifetime risk of death being 1 in 55. Disease initiation probably occurs during the ages 30 – 50. Changes in diet and the use of new biomarkers could reduce the incidence by 50%. A reduction in deaths from colorectal cancer by 50% would mean approx $11 billion per year additional total benefit to the Australian economy.

A large and growing amount of private sector investment is being devoted to commercialising new discoveries in diagnosis and prevention, including new markers, new array technologies, informatics and personal predisposition analysis services. Australian science is at the leading edge in a number of these capabilities and integrating related disciplines, equipment and data-bases can provide a vital platform for the commercialisation of local discoveries.

CSIRO's Approach

CSIRO's research relates to the subject of this Inquiry through the aim to extend productive life as a part of overall life expectancy, enabling Australian's to work longer and more productively, enjoy life more fully and reduce the cost of public health care.

Preventative Health in an Ageing Population

Australia has a relatively small but genetically diverse population. At one extreme there is an ageing population as a consequence of a declining birth-rate and increased longevity due to improved healthcare. At the other extreme, Generation Y (< 24 years) currently represents the single largest demographic group since the "Baby Boomer" generation. Both populations have very different health profiles and needs for preventative healthcare. In the middle of the population age distribution there are significant numbers of people unknowingly developing signs of debilitating diseases that will become manifest in the next decade. Emerging technologies will enable diagnosis of disease predisposition and set the scene for preventative interventions.

The aim is to:

- Develop new ways to identify disease before it becomes serious.
- Use genes and proteins to predict and prevent ill-health.
- Develop powerful new tools to analyse the massive volume of information about disease and its causes.
- Pinpoint external causes of disease such as diet, lifestyle and environmental conditions.
- Develop better ways to measure and monitor health and health issues.

This will form the core of a new export industry cluster in preventative healthcare products and services and will provide an estimated benefit of $89 billion in reduced costs and more productive people.

Preventative health research in CSIRO will address the following areas:

- Colorectal cancer.
- Neurodegenerative diseases and mental ill-health.
- Biodiscovery.
- Obesity.
- Diabetes.
- Cardiovascular disease.
- Asthma.
- Environment and health.
- National health data network.

CSIRO conducts life science research focused on the improvement of well being and community health through skills in the key areas of preventative health, diagnostics and therapeutics.

- Preventative Health:
  - Identifying food-related bioactive compounds.
  - Increasing our understanding of consumer health-related behaviour.
  - Development of products for prevention of chronic diseases and cognitive decline.

- Diagnostics:
  - Development of new diagnostic assays and reagents.
  - Identification of biomarkers utilising antibody and protein engineering.
- Therapeutics:
  - Understanding protein structure to identify potential therapeutics targeted towards large markets with unmet medical needs.

Air Pollution and Health in an Ageing Population

The elderly are known to be more susceptible than the general population when it comes to the health impact of air pollution. With projected urban, economic and population growth, future pressure on the air environment will be significant, unless design and control measures are developed to counter this. Hence long-term strategies should include strategies to protect Australia's elderly from the adverse effects of air pollution.

Current Air Environmental Health Issues:

- ABS (2002) notes that:
  - The 1995 National Health Survey estimated that 11.3% of Australians (2.04 million people) had asthma, generally as a long-term condition.
  - In 1999 death rates from asthma were highest for those aged 65 years and over for both males and females.

- Short-term increases in ambient particles are implicated in excess deaths, particularly of older, unwell people. In Melbourne:
  - Ambient particles are estimated as responsible for 460 (acute) deaths per year. [Air NEPM (1998)].
  - There is no safe concentration level for particles in the ambient air.

- A recent report of results from tracking 500,000 Americans for 16 years found long-term (chronic) exposure to fine particles significantly increased deaths from lung cancer and heart diseases [Pope & Thurston (2002)].
  - Lung cancer deaths increased by 8% for every 10 $\mu g/m^3$ increase in fine particles in the air. [In Australia's bigger cities the concentration is ~ 25 $\mu g/m^3$.]
  - Cardio-pulmonary disease deaths rose 6% with the same exposure conditions.
  - The risk of dying from lung cancer as well as heart disease in the most-polluted cities was comparable to the risk associated with non-smokers being exposed to second-hand smoke over a long period of time.

- Australia has had demonstrable success in controlling air pollution over the years - see Australia 2001 State of Environment Report.[1]

[1] See Manins, P., Allan, R., Beer, T., Fraser, P., Holper, P., Suppiah, R. and Walsh K., 2001. Atmosphere, Australia State of the Environment Report 2001 (Theme Report), CSIRO Publishing on behalf of the Department of the Environment and Heritage, Canberra.

Exposure to Air Pollution:

- The air pollution health issue is exposure of the public to pollutants, especially fine particles, in the air. Older people are particularly at risk. The risks can be managed by:
  - Reducing emissions of pollution to the ambient atmosphere.
  - Reducing emissions of pollution indoors.
  - Reducing the risk of exposure to pollution.

- Motor vehicle emissions are the most important source of pollutants in Australian cities.
  - Introduction of Euro vehicle emission standards over the next six years will eventually make a major improvement to vehicle pollution emissions, but because of the slow vehicle replacement rate (average age of vehicles is 10 years in Australia), it will not be until around 2015–2020 before a substantial benefit from these standards will be felt.
  - In the near term, diesel vehicles are likely to make air pollution worse since their numbers are increasing in Australia much faster than petrol vehicles.
  - New technology vehicles such as hybrid cars which emit one tenth of the pollution of current cars will usher in the use of fuel cells and, eventually, hydrogen fuel, which has zero emissions at point of use.
  - It is likely to take a large fraction of the next 40 years for the hydrogen economy to be widespread enough to have a significant air quality benefit.

- Domestic air pollution, both indoors due to indoor activities and materials, and outdoors due to indoor sources such as wood-fuelled heaters, will continue to be an important issue unless better technologies and regulations are introduced.
  - Ventilation rates of homes and offices are becoming lower to save energy. But reduced ventilation leads to increased air pollution concentrations from indoor sources.
  - Older people generally spend more time indoors, perhaps in institutions, where choices of materials, cleaning, heating and cooking methods make huge differences to exposure to air pollutants.

- Controlling exposure to air pollution will become far more effective as information on the important pathways to exposure is delineated. Refining the relationships between environmental factors and cardio-pulmonary illnesses will occur as the signal-to-noise in epidemiological studies is improved by more definitive use of spatial and temporal environmental data and subject risk factor data.
  - Provision of information to the public, to advisors and to regulators about those activities and choices that lead to different outcomes for exposure to air pollution is an important development that is yet to occur.
  - Better understanding of the exposure risk will lead to integration of such information with the Australian Air Quality Forecasting System (eg., for Melbourne hour by hour forecasts are given suburb by suburb every day at www.epa.vic.gov.au/air/AAQFS) This will help provide advice to the public and guide environment agencies and

health agencies to control traffic use (while zero exhaust emissions, yet continued road emissions) and hospital management of high pollution days.

- Research on personal exposure to air pollution is necessary to provide the information that will save lives and improve the quality of life.
  - A major benefit will be strategies that protect the health of the elderly, both from short-term exposures that over-stress compromised health, and from long-term exposures that lead to chronic illnesses and cancers.
  - While the balance of air pollution issues will change radically over the next 40 years, strategic information on personal exposure will need regular renewal to assure relevance.

Information & Communications Technology in Relation to an Ageing Population

The provision of services to support increasing numbers of aged people will benefit from developments now taking place in information and communications technology (ICT), particularly via improvements in the home information infrastructure.

- Isolation and loneliness are already being compensated by the use of computers and the World Wide Web by the elderly; this will increase as today's baby boomers move into the older age group.

- Other forms of technological assistance will permit independent living by individuals who might otherwise need to be cared for in nursing homes or other forms of institutionalised care. For example, current personal alarm systems can be augmented by systems which can automatically detect medical or other emergencies and monitor an individual's vital signs.

- The savings in the cost of hospital beds of the widespread use of such systems would be very large – our research suggests that if such a system were successfully implemented across all congestive heart failure, hypertension, chronic obstructive pulmonary disease and diabetes sufferers in the older age group, the direct care savings in Australia could amount to $372 million, with a further saving of $72 million in infrastructure costs.

- Such a system is being developed within CSIRO as the Hospital Without Walls project. This incorporates a range of CSIRO technologies, particularly information, communications and biosensing, into a system aimed at supporting independent living in the elderly or chronically ill.

- A current emphasis of this work is the early detection and reduction of falls in the elderly. The lifetime care costs of falls in one year amount to approximately $1billion, and the CSIRO system is particularly targeted at reducing the personal and financial burdens imposed by falls in the elderly.

- This technology is particularly relevant to rural and remote areas, where there is a strong desire on the part ageing rural population to continue to live at home or in the local community.

- CSIRO is also working on a number of ICT-based technologies aimed at reducing the costs of providing services to rural and remote areas, and increasing equity of access to services, through telecollaboration and other telehealth initiatives.

- We are working to improve surgical techniques through computer based surgical planning and training tools; this will make surgery more reliable and less traumatic through increased use of minimal-access techniques.

SUMMARY

Australia is facing challenging problems and research can help to address them. As Australia's largest public sector agency CSIRO is well positioned to deliver for the government on a range of issues that will promote economic development and environmental improvement in ways that will strengthen Australia's capacity to cope with an aging population. More specifically, CSIRO can help address the health issues associated with the ageing of the Australian population through multidisciplinary research designed to deliver scientific solutions to advance Australia's important objective in terms of longer, healthier, more productive lives for Australians. This in turn will assist in reducing government spending on health over the next 40 years.