

FRAMEWORK PAPER

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**Developing an Integrated Approach
to Emerging Health Challenges**

Centre for Strategic Economic Studies
Victoria University, Melbourne, 2007

Developing an Integrated Approach to Emerging Health Challenges

Framework Paper

Executive Summary

Recent decades have seen rising prosperity in most APEC economies, with strong economic growth and better health outcomes underpinned by rapid growth in the working age population. Since 1960 life expectancy has grown by at least 15-20 years in most economies, and by much more in some, as many communicable diseases have been brought under control. Across the region, the population in the prime working age group (25-54 years) grew by 600 million persons or 2.6% per annum over 1960-2005, providing the dominant source of both labour supply and household demand. Strong economic growth has in turn provided increasing resources for health programs.

New and quite different realities confront APEC economies in the first half of the 21st Century. While communicable diseases, including HIV/AIDS, remain a serious problem, the central health issue is that all economies face a rapid rise in chronic diseases such as cancer, diabetes and cardiovascular and respiratory diseases. The rise in chronic diseases will cause suffering and premature loss of life; they are also costly to diagnose and treat, and will impose new pressures on health budgets. At the same time sharp changes are taking place in the age structure of the population of the APEC region – there will be no growth in the prime working age population over 2005-50 but an increase of 670 million persons aged 55 years and over. This will mean slower workforce and economic growth, together with rising demands on pension and social security systems. Managing these inter-related challenges to growth, health policy and financial sustainability will require substantial but well-planned investments in health innovation, guided by an integrated approach bringing together economic, financial, technology and health policy expertise.

Key Health Challenges

New data from the World Health Organisation (WHO), on projected mortality and the burden of disease for the APEC region to 2030, are now available and allow the key health challenges facing the region to be better defined¹. These data are provided for two groups of economies within APEC – referred to here as developed and developing economies.

Deaths from communicable, maternal, perinatal and nutritional conditions ('communicable diseases') totalled 2.3 million in the APEC region in 2005, of which 1.9 million were in developing economies. Deaths from these causes are projected to remain at 2.0 million (and

¹ This paper was prepared by Peter Sheehan, Bruce Rasmussen and Kim Sweeny. The authors are most grateful to Dr Colin Mathers of the Evidence and Information for Policy Cluster of WHO for the provision of unpublished baseline projections of global mortality and the burden of disease to 2030 for the two groups of APEC economies. Detailed data are provided in the Appendix.

1.7 million in developing economies, of which HIV/AIDS accounts for 55%) in 2030. Deaths from injuries (e.g. road accidents and intentional injuries) are also expected to remain at a high level, and to increase by 9% to 2.3 million for the region as a whole in 2030.

But deaths from chronic diseases in the APEC region are projected to rise 41% to 22.2 million by 2030, with 17.5 million being in the developing economies, a rise of 46%. In the developing economies deaths from heart disease are expected to rise by 23% to 7.0 million by 2030, with deaths from cancer rising by 63% to 4.5 million, from respiratory diseases by 98% to 3.8 million and from diabetes by 110% to 700,000. These projections, assuming as they do continuing gains in health outcomes from rising incomes, better education and improving medical services, dramatise the massive task facing health systems in the region. The stark mortality figures simply hint at the underlying realities, for individuals and communities, of this rise in chronic disease.

Changes in Age Structure

Some simple facts illustrate equally starkly the extent of the changes underway in the age structure of the region's population. The number of young people (less than 25 years old) will be 215 million (19%) lower in 2050 than in 2005. By contrast with the rise of 600 million over 1960-2005, the population aged 25-54 years will fall by 20 million or 2% over the later period, removing an important component of earlier growth. But the population aged 55-74 years will increase by 406 million persons (1.6% per annum) and that 75 years and older by some 268 million (3.1% per annum) over that period. While population ageing is taking place in all economies, its timing and speed differs widely across economies.

Investment in Cost-effective Innovation in Health

There is now a vast repository of medical knowledge and of proven technologies available for use in APEC economies, and new products and methods are emerging all the time. This existing and emerging knowledge can be the basis for cost-effective innovation, having regard to the specific needs and circumstances of each economy, to provide the best outcome in terms of health, development and fiscal sustainability. Here innovation is defined as the creation and use of knowledge new to the specific context in which it is applied, across all dimensions of the health system, from new medicines and advanced detection and treatment to policy frameworks, insurance arrangements, rural and urban health infrastructure and governance structures. Increased investment in cost-effective health innovation will be necessary to meet the twin challenges of chronic disease and ageing, especially in those economies where priority in public spending has focused on economic growth rather than on health and where private spending has been constrained by inadequate supply of quality services.

The stakes involved in effective policy and in such increased investment are massive. If death rates from chronic disease in APEC could be reduced by an additional 1.5% per annum from 2010 to 2030 (relative to the WHO projection), about 6 million deaths from chronic diseases in the region would be averted in 2030². Some 60 million deaths, and the loss of

² WHO proposed in 2005 a target of an additional reduction of 2% per annum in death rates from chronic disease, over the period 2005-2015 (WHO 2005; Strong et al. 2005).

over 800 million disability-adjusted life years, would be averted over this full period of twenty years, about 90% of which would be in the developing economies, and over half in people less than 70 years of age. As a death from chronic disease is often the end point of prolonged and expensive treatment, the gross savings to health budgets could be large, while the potential labour force would be substantially increased.

Key Role for Prevention, Early Detection and Early Intervention.

Given the human, economic and financial costs of chronic diseases, there is a strong case for increased investment in prevention and early detection and intervention. Here we refer to activities across the whole spectrum: improved sanitation and living conditions in poor areas; prevention programs, including lifestyle changes and preventive medicine based on known risk factors (such smoking, alcohol use, obesity and blood lipid levels) and systematic monitoring of such risk factors; expanded vaccination programs, with older proven vaccines or new ones in the pipeline; and advanced screening and biomarker projects to identify and treat the preconditions for disease. This applies both to the developed economies, where much chronic disease could still be averted by early action, and to the developing economies, many of whom have not yet had the time or resources to build appropriate programs.

Other Aspects of Innovation in Health

In encouraging increased investment in health innovation it will be necessary to find the right balance in many areas: between the use of public and private resources; between providing an appropriate return for innovation and delivering accessible, high quality services to the whole population at an affordable cost; between cost-effectiveness analysis and reliance on market forces, and so on. All economies, however rich or poor, face the challenge of building enhanced domestic capability to be able to participate in and benefit from continued progress in the life sciences and to meet the challenge of chronic diseases and ageing populations. In this process it will be necessary both to marshal public resources and to draw on private funding, and properly designed public-private partnerships can play a significant role.

Conclusion – Towards an Integrated Approach

The new centrality of health policy to both economic outcomes and to financial sustainability is a fundamental fact of the 21st Century. Much will depend, for both economic growth and health budgets, on the wellbeing of large cohorts of people as they age. If effective health innovation allows them to remain healthy and active, labour supply will increase and future health and pension costs will be contained, even as the growth dividend provides more resources to meet those health costs. But if effective innovation is not achieved, high health and pension costs will be a drag on economies with limited ability to generate additional resources to meet these costs.

This effective innovation will not be achieved by economic or finance experts or by health professionals working alone, or by government or business independently of one another. An integrated approach is required, bringing together expertise in health policy and management, economic and financial analysis and science and technology from government, academia and the business community.

1. Introduction

At their October 2002 meeting the APEC Leaders, in establishing LSIF, stressed the need ‘to be more effective with our investment at every stage of the health care process, including primary prevention against disease risks, and focusing on most vulnerable populations’. Given its overall remit, and the progress that has been made in other areas, LSIF IV in 2006 adopted as a key theme the efficient and effective allocation of resources to promote innovation, and of regulatory frameworks that facilitate access to new technologies, as a response to the challenges facing health care systems. A central outcome of the discussions at LSIF IV was need to develop an integrated approach to the emerging health challenges facing APEC economies, one which brought together scientific, economic and health policy expertise and drew on the resources of government, business and academia. The key theme for LSIF V in 2007 has therefore been set as *Developing an Integrated and Innovative Approach to Emerging Challenges*. This paper sets out to provide some background for the discussion of these issues at LSIF V, building on the framework paper prepared for LSIF IV (CSES 2006).

The context of this analysis remains, as earlier, one of health care systems under considerable stress in most economies, with growing demand for services, including those using new technologies, and limits on financial resources even in the richest economies. At the same time, innovation in health systems has contributed greatly to increased longevity and quality of life in recent decades, and there is strong potential for further gains. Among the factors contributing to the unique mix of pressures and opportunities are:

- a new wave of technological innovation, offering better and more targeted methods for detection, diagnosis and treatment of disease;
- the high costs of applying advanced medical technologies, including building the skill and infrastructure base for effective use, together with the additional costs of emerging technologies;
- demographic and lifestyle factors (such as ageing and obesity) that increase the need for health care services;
- growing pressures on governments to contain spending on innovative health technologies to manage health costs; and
- continuing inequality in access to health care services, with the ongoing need to extend high quality services to less privileged groups, even though the technological intensity of those services continues to increase.

In providing the framework for the discussions at LSIF V, this paper outlines projected trends in mortality and the burden of disease in APEC economies to 2030, reviews the implications of the UN’s population projections out to 2050 for the economies of APEC, discusses the richer innovative resources that are available to address emerging challenges and provides some broad estimates of the gains to be achieved from effective innovation policy. It then briefly reviews some key themes concerning an integrated approach to increased investment in health innovation to meet these challenges.

2. The Changing Burden of Disease in APEC Economies

Projected Trends in Deaths and DALYS by Disease

The previous framework paper (CSES 2006) emphasised the changing pattern of disease burden and in particular the growing importance of chronic diseases. That analysis was largely undertaken at the level of the WHO Western Pacific Region, which included a number of APEC members as well as data for a number non-APEC economies, but excluded a number of others including the larger populations of United States, Indonesia and Russia. With the more accurately targeted data now available for APEC members only, divided between two groups of developing and developed economies, it is possible to re-examine these same trends using this more relevant data set.

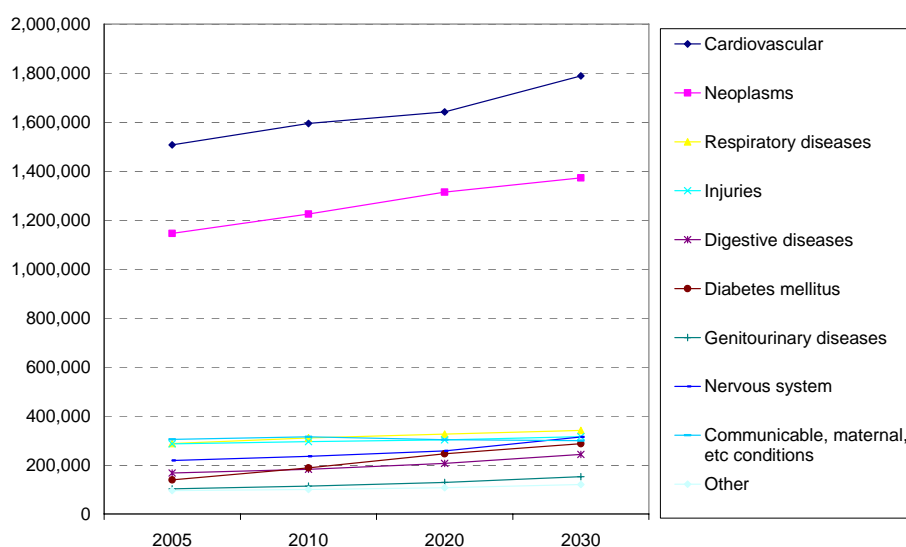
The methodology used by the authors of the WHO projections of age specific death rates, for major causes, is based on the assumption that the past positive impact of growth in GDP, the increase in human capital and technology and related factors (proxied by a time trend) on health outcomes will continue in the projection period, on an individual economy basis and for age and gender groups Mathers and Loncar (2006). Specific projections were made of deaths from HIV/AIDS, tuberculosis and tobacco-related deaths.

Table 1. Deaths in APEC developed and developing economies, 2005-2030, by broad cause

| | APEC developed economies | | | APEC developing economies | | | All APEC | | |
|--------------|--------------------------|------|------------------|---------------------------|-----------|------------------|----------|------|------------------|
| | Number | | Change in period | Number | | Change in period | Number | | Change in period |
| | 2005 | 2030 | | 2005 | 2030 | | 2005 | 2030 | |
| | (million) | (%) | (million) | (%) | (million) | (%) | | (%) | |
| Communicable | 0.3 | 0.3 | -1.3 | 1.9 | 1.7 | -13.1 | 2.3 | 2.0 | -15.2 |
| Chronic | 3.7 | 4.6 | 26.1 | 12.0 | 17.5 | 46.1 | 15.7 | 22.2 | 41.1 |
| Other | 0.3 | 0.3 | 10.2 | 1.8 | 1.9 | 3.9 | 2.0 | 2.2 | 9.4 |
| Total | 4.3 | 5.2 | 23.1 | 15.8 | 21.1 | 33.3 | 20.4 | 26.3 | 28.9 |

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

The analysis of this new data set not only confirms the earlier analysis, but makes some of the conclusions even more clear cut. A summary of the mortality projections, by broad cause of disease, is provided in Table 1. Deaths from communicable, maternal, perinatal and nutritional conditions ('communicable diseases') totalled 2.3 million in the APEC region in 2005, of which 1.9 million were in developing economies. Deaths from these causes are projected to decline by 15% over the period to 2030, but to remain at the relatively high level of 2.0 million. Of these deaths 1.7 million are in developing economies, of which deaths HIV/AIDS accounts for 55%. Deaths from HIV/AIDS in APEC economies in 2030 are projected at 910,000, more than a fivefold increase on the figure for 2005. Thus the projections imply substantial reduction in deaths from other communicable diseases in the developing economies to 2030. Deaths from injuries (such as road accidents and other accidents, intentional self-harm and other forms of violence and war) are also expected to remain at a high level, and to increase by 9% to 2.3 million for the region as a whole in 2030.

Figure 1. Projected deaths by major disease categories, APEC developed economies, 2005-2030

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

It is clear from Table 1, however, that the main challenge is the rise in chronic diseases, deaths from which in the APEC region are projected to rise 41% to 22.2 million by 2030, with 17.5 million being in the developing economies, a rise of 46%. These trends should be seen in the context of growth in the overall population of developed and developing regions of APEC of 12% and 16% respectively over 2005-30. More detail on these deaths, by major disease class, is provided in the Figures 1 and 2 and Table 2.

Table 2. Deaths and rates of change in numbers of deaths, by cause of death: APEC developed and developing economies, 2005-2030

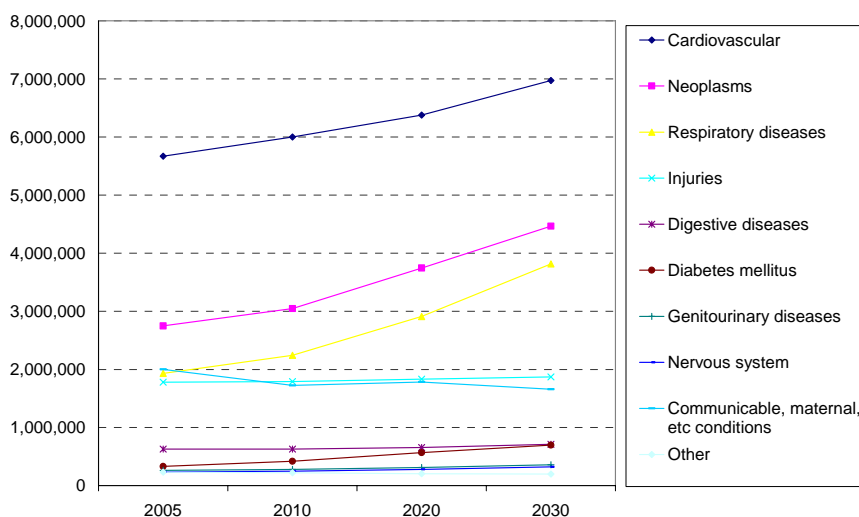
| Cause of death | Developed economies | | | Developing economies | | |
|------------------------|---------------------|------|----------------------|----------------------|------|----------------------|
| | Number of deaths | | Change in period (%) | Number of deaths | | Change in Period (%) |
| | (million) | | | (million) | | |
| | 2005 | 2030 | | 2005 | 2030 | |
| Cardiovascular | 1.5 | 1.8 | 18.7 | 5.7 | 7.0 | 23.0 |
| Neoplasms | 1.1 | 1.4 | 19.8 | 2.7 | 4.5 | 62.5 |
| Respiratory diseases | 0.3 | 0.3 | 18.8 | 1.9 | 3.8 | 97.5 |
| Injuries | 0.3 | 0.3 | 10.2 | 1.8 | 1.9 | 5.2 |
| Digestive diseases | 0.2 | 0.2 | 45.7 | 0.6 | 0.7 | 13.4 |
| Diabetes mellitus | 0.1 | 0.3 | 105.7 | 0.3 | 0.7 | 110.9 |
| Genitourinary diseases | 0.1 | 0.2 | 47.4 | 0.3 | 0.4 | 36.4 |
| Nervous system | 0.2 | 0.3 | 44.1 | 0.2 | 0.3 | 37.8 |
| Communicable | 0.3 | 0.3 | -1.6 | 2.0 | 1.7 | -17.0 |
| Other | 0.1 | 0.1 | 26.0 | 0.2 | 0.2 | -15.4 |
| All causes | 4.3 | 5.2 | 23.1 | 15.8 | 21.1 | 33.3 |

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

For the developed economies two causes of disease dominate, namely cardiovascular diseases and cancer (neoplasms). In these economies deaths from these diseases are expected to rise by 19% (to 1.8 million in 2030) and by 20% (to just on 1.4 million) for cardiovascular diseases and cancer respectively, and together to account for 60% of deaths in 2030. A number of other chronic diseases, while small in terms of the overall share of deaths, are projected to rise rapidly. These include digestive diseases, diabetes (deaths from which are expected to more than double between 2005 and 2030), genitourinary diseases and diseases of the nervous system, such as dementia.

For the developing economies of APEC, cardiovascular diseases and cancer are still by far the largest cause of death by 2030, deaths from these two causes increasing by 23% to 7.0 million for cardiovascular disease and by 63% to 4.5 million for cancer. However, there are other respects in which the patterns are quite different. Respiratory diseases, which for developed economies are one of a cluster of lower ranked diseases, are the third most important cause of death for developing economies by 2010 and are projected to grow rapidly. Deaths from respiratory diseases are projected to rise to 3.8 million in these economies in 2030, an increase of 98% on 2005. This is likely to reflect continuing high levels of smoking and air pollution in some of these economies. Deaths from diabetes, while still well below those from the major causes, are projected to grow by 111% over 2005-50, presumably reflecting the expected impact of changing lifestyles and diets. Injuries and communicable, maternal and related conditions are projected to remain at much higher levels relative to other causes of death in developed economies. Motor vehicle accidents are the cause of about 40% of the high level of death due to injuries in the APEC developing economies.

Figure 2. Projected deaths by major disease categories, APEC developing economies, 2005-2030



Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

Another measure of the impact of disease is the disability-adjusted life years lost (DALYs) measure developed in the Global Burden of Disease Project. DALYs are calculated by summing the years of life lost as a result of early death and the proportion of years of quality life lost by living with a disability of known severity and duration. One effect of the use of

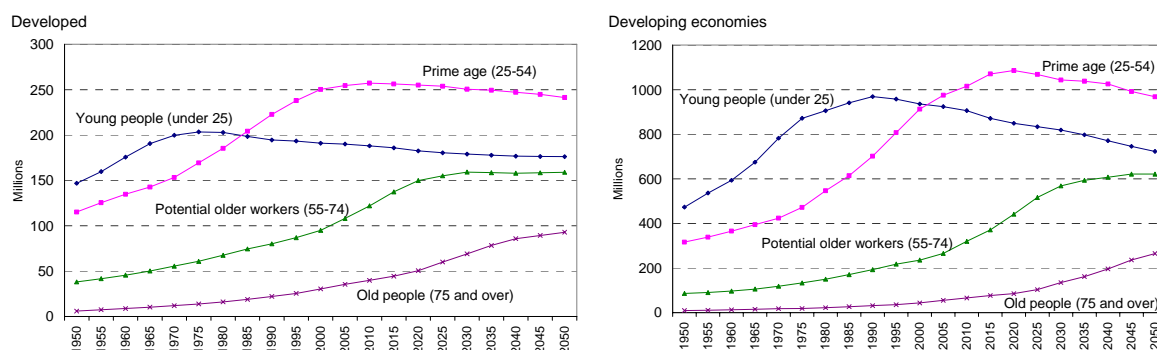
DALYs rather than deaths is that deaths that occur at young ages, such as those from many communicable diseases, save more DALYs than deaths occurring at older ages. The available data on the WHO projections for the APEC region to 2030 are summarised in Appendix Tables A1 and A2. For both regions of APEC the number of DALYs lost in 2030 from communicable diseases are expected to be lower than in 2005, by 41% for developed economies and by 33% for developing economies. But DALYs lost from non-communicable diseases are projected to rise in both groups over 2005-30, by 4.5% and 11.4% respectively. One important aspect of these data is that they highlight the burden arising from diseases such as neuropsychiatric conditions, sense organ diseases and musculoskeletal diseases which can cause severe disability without being a direct cause of death. For example, these three disease types are projected to account for over 40% of DALYs lost in APEC developed economies in 2030 and about 30% in developing economies.

3. The Implications of Population Ageing in APEC Economies

Since the Industrial Revolution, and especially over the past 50 years or so, global development has taken place in the context of rapid growth in population, with the numbers of both young people seeking education and of persons in prime age rising rapidly. For the APEC region the total population more than doubled from 1.2 billion to 2.8 billion over 1950-2005, an increase of 1.6% per annum. The number of young people (less than 25 years old) also more than doubled, increasing by 1.4% per annum, while the population aged 25-54 years almost trebled, rising from 0.43 billion to 1.23 billion, and increase of 600 million persons or 1.9% per annum.

This pattern of population growth generated its own pressures, with high demand for education and the need for rapid growth in job opportunities. But as growth did develop it provided the growing workforce to service that growth, and the spending power of the increasing number of workers sustained domestic demand. For a given level of development, pressures on the health and social security systems were modest, as persons aged 55 years accounted on average for only one in eight of the population over this time.

Figure 3. Population by broad age groups, developed and developing economies in APEC, 1950-2050 (million persons)



Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

As is widely known, APEC economies face very different population dynamics over the period to 2050 as a result of population ageing. These dynamics, which will have major

implications for both patterns of economic development and for health systems, are reviewed briefly below. The projections used here are drawn from the 2006 revision of the UN World Population Prospects (UN 2006). The UN estimates use mortality projections produced by the United Nations Population Division rather than the WHO, and hence these projections are not necessarily consistent with those underlying the WHO data discussed above. The WHO analysis does, however, use the UN projections for fertility and migration rates, so that any differences should be confined to those arising from different mortality projections.

The Broad Picture – Developed and Developing Economies within APEC

The broad population trends for developed and developing APEC economies are provided in Figure 3 and Tables 3 and 4. Those trends are indeed remarkably similar in aggregate for the two groups of economies, although key turning points occur later for developing economies and there are, as we shall see, significant differences between economies within both groups.

Table 3. Percentage change in population, selected APEC economies, by age group, 1960-2005 and 2005-2050 (total per cent change over period)

| | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (over 75) | Grand total |
|----------------------|----------------------------|----------------------|------------------------------------|-------------------------|----------------|
| 1960-2005 (%) | | | | | |
| Developed economies | 8.2 | 88.8 | 137.2 | 306.3 | 61.3 |
| USA | 27.2 | 82.1 | 78.0 | 209.2 | 61.1 |
| Japan | -31.0 | 45.0 | 214.6 | 590.0 | 35.9 |
| Australia | 49.4 | 115.8 | 148.6 | 360.4 | 97.7 |
| Developing economies | 55.6 | 166.7 | 174.6 | 318.0 | 107.6 |
| China | 38.7 | 169.0 | 172.8 | 336.9 | 99.7 |
| Korea | 4.5 | 191.5 | 351.8 | 482.6 | 91.4 |
| Indonesia | 88.0 | 194.8 | 240.7 | 309.1 | 135.7 |
| Malaysia | 153.8 | 319.7 | 332.6 | 228.8 | 215.2 |
| Philippines | 172.3 | 286.7 | 279.9 | 289.1 | 212.6 |
| Thailand | 38.8 | 245.7 | 352.4 | 579.4 | 127.8 |
| All APEC | 44.8 | 145.7 | 162.7 | 313.3 | 95.8 |
| 2005-2050 (%) | | | | | |
| Developed economies | -7.2 | -5.2 | 47.0 | 174.9 | 14.8 |
| USA | 11.9 | 19.5 | 75.9 | 154.5 | 34.2 |
| Japan | -37.3 | -39.6 | -16.5 | 110.2 | -19.8 |
| Australia | 14.7 | 16.4 | 74.1 | 209.7 | 38.1 |
| Developing economies | -21.8 | -0.7 | 133.7 | 390.5 | 16.4 |
| China | -26.5 | -16.6 | 109.8 | 420.8 | 7.3 |
| Korea | -50.8 | -41.7 | 68.5 | 487.4 | -11.6 |
| Indonesia | -17.3 | 24.6 | 207.2 | 547.8 | 31.3 |
| Malaysia | -6.1 | 59.4 | 281.5 | 717.8 | 54.5 |
| Philippines | 0.0 | 99.1 | 315.3 | 664.6 | 66.1 |
| Thailand | -23.4 | -15.0 | 97.0 | 358.3 | 6.9 |
| All APEC | -19.3 | -1.6 | 108.7 | 305.3 | 16.1 |

Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

Starting with the first of the four age groups distinguished in Figure 3, the number of young people (those less than 25 years) peaked in the developed economies in 1975 and in the developing economies in 1990, and has since fallen in both groups. However, the projected

fall over 2005-2050 is stronger in the developing economies (22% over the period) than in the developed economies (7%), some of which have higher birth rates and/or significant inward migration programs. Given the early peaking of the number of young people in both groups, the decline in the population share of young people over 2005-2050 is similar to that which occurred in the previous 45 years (Table 4).

The group of persons aged 25-54 years is particularly important in economic terms, as they are the central providers of human resources to the economy and have been pivotal to the development of these economies in recent decades. As is evident from Chart 3, the population in the prime adult age groups (25-54 years) is expected to peak in the developed economies as a whole in 2010, before gradually declining over the period to 2050. The prime adult age population of these economies is expected to be 5% lower in 2050 than in 2005 (Table 3), which contrasts sharply with an increase of 89% over 1960-2005. For developing economies the peak is again later (in 2020), but the fall is sharper. Overall, in the developing economies of APEC the population aged 25-54 years is expected to be about 1% lower in 2050 than in 2005, by comparison with an increase of 175% over 1960-2005. The decline after 2020 is, however, quite rapid – between 2020 and 2050 the prime age population in the developing economies falls by about 120 million persons (0.4% per annum).

Table 4. Change in share of population, selected APEC economies, by age group, (percentage points)

| | Young people (below 25) | Prime age (25- 54) | Potential older workers (55-74) | Old people (over 75) |
|----------------------|----------------------------|-----------------------|------------------------------------|-------------------------|
| 1960-2005 (%) | | | | |
| Developed economies | -15.9 | 6.3 | 5.9 | 3.7 |
| USA | -9.3 | 4.9 | 1.6 | 2.9 |
| Japan | -24.2 | 2.5 | 14.5 | 7.1 |
| Australia | -10.8 | 3.6 | 3.6 | 3.6 |
| Developing economies | -13.9 | 9.7 | 2.9 | 1.3 |
| China | -16.8 | 11.9 | 3.4 | 1.4 |
| Korea | -27.6 | 16.5 | 9.0 | 2.0 |
| Indonesia | -12.0 | 8.2 | 3.1 | 0.7 |
| Malaysia | -12.2 | 9.8 | 2.4 | 0.1 |
| Philippines | -8.3 | 6.7 | 1.3 | 0.2 |
| Thailand | -24.2 | 15.8 | 6.6 | 1.8 |
| All APEC | -14.0 | 8.9 | 3.4 | 1.7 |
| 2005-2050 (%) | | | | |
| Developed economies | -6.2 | -7.5 | 5.2 | 8.6 |
| USA | -5.8 | -4.6 | 5.1 | 5.4 |
| Japan | -5.4 | -10.0 | 1.1 | 14.4 |
| Australia | -5.6 | -6.7 | 4.6 | 7.8 |
| Developing economies | -13.6 | -6.4 | 12.1 | 8.0 |
| Malaysia | -12.0 | -10.3 | 12.3 | 10.0 |
| Philippines | -14.7 | -16.4 | 14.2 | 17.0 |
| Thailand | -17.5 | -2.1 | 13.4 | 6.2 |
| China | -19.8 | 1.3 | 12.8 | 5.7 |
| Korea | -22.3 | 7.0 | 11.4 | 4.0 |
| Indonesia | -10.7 | -9.5 | 11.2 | 9.0 |
| All APEC | -12.1 | -6.7 | 10.6 | 8.1 |

Source: Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

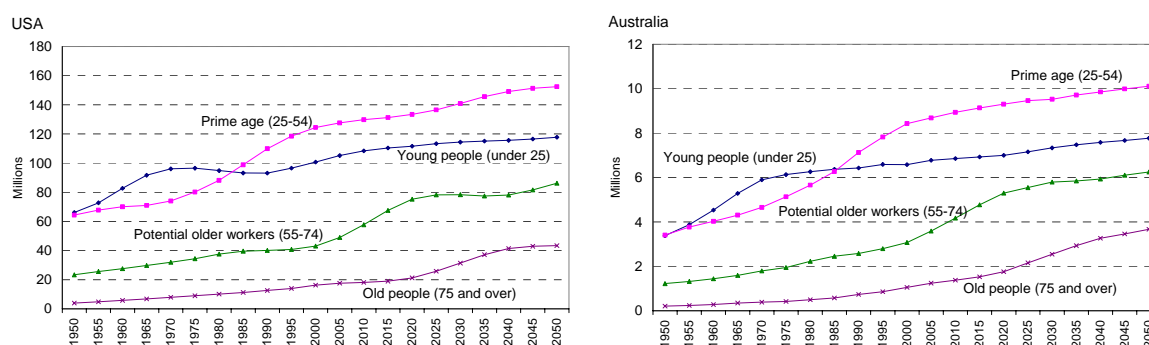
The counterpart to these trends is rapid growth in older populations, which we discuss in terms of two categories: persons aged 55-74 years, which we call potential older workers, and persons 75 years and over, referred to as old people. As is evident from Figure 3, the number of persons in both older age groups has been rising gradually since 1950, but had reached only 13.3% and 3.2% of the total APEC population for the two age groups respectively by 2005.

For the 55-74 years age group, the population growth rate accelerates after 2000 in both groups. For developed economies the number of persons in this age group grows by 2.3% per annum over 2000-2020, after which the rate of increase slows before the overall level peaks in 2030. For developing economies population aged 55-74 years grows by 3.2% per annum over 2000-2030, before the rate of growth slows and the population level peaks about 2050. For APEC as a whole the population in this age group increases by 415 million between 2000 and 2035, and by 450 million by 2050. As a result their share of the overall population virtually doubles, from 12.3% in 2000 to 24% in 2050.

Population Trends within Developed Economies

All of the developed economies in APEC are experiencing quite pronounced population ageing, but there are quite different trends in economies such as USA and Australia (Figure 4), on the one hand, and East Asian nations such as Japan and Singapore on the other (Figure 5).

Figure 4. Population by broad age groups, USA and Australia, 1950-2050



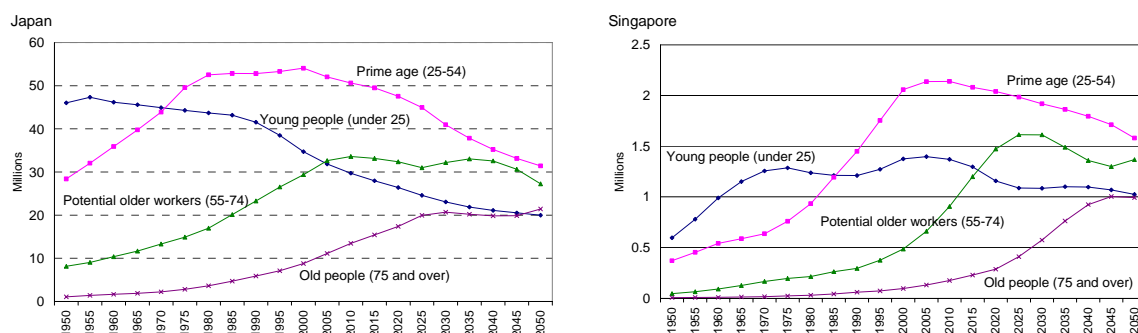
Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

In USA and Australia higher birth rates and continued net inward migration mean that both the number of young people and of persons aged 25-54 years grows steadily throughout the 2005-2050 period, albeit at a less rapid rate than in the older age groups. Both USA and Australia saw rapid growth in the prime age population over 1970-2000, as the 'baby boomers' born after the Second World War moved into that age group: the population aged 25-54 years grew by 68% or 1.7% per annum in the USA, and by 81% or 2.0% per annum in Australia, between 1970 and 2000. But, by contrast with many other economies, in both economies the numbers in that age group will continue to increase through to 2050. As this wave passes on, both economies are currently in the midst of rapid growth in the population aged 55-74 years – numbers in this age groups are projected to grow by 75% (1.9% per annum) in the USA and by 72% (1.8% per annum) over 2000-2020. As noted in CSES

(2006), these economies have been successful in keeping older persons active in the workforce: between 1998 and 2006 64% of the growth in employment in the USA was provided by persons aged over 55 years, while such older persons 55 contributed 43.8% of the growth in total employment in Australia over 2001-2006.

By contrast with these two economies, the speed of ageing is much more dramatic in Japan and Singapore (Figure 5). The Japanese population has been ageing since the 1960s and the process is now well advanced. The number of young people in Japan is likely to be 12 million or 37% lower in 2050 than in 2005, and to comprise only 20% of the total population in 2050 by comparison with 55% in 1950. The prime age population (aged 25-54 years) is projected to be 21 million or 40% lower in 2050 than in 2005. But in Japan's case these trends are more associated with overall population decline than with rising numbers of older people. As Figure 5 shows, the number of potential older workers (persons aged 55-74 years) will be lower in 2050 than in 2005, and the number of persons aged 75 years and over stabilises after 2025. Nevertheless, there is a very pronounced rise in the share of Japan's population in the oldest age group (Table 4).

Figure 5. Population by broad age groups, Japan and Singapore, 1950-2050



Source: Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

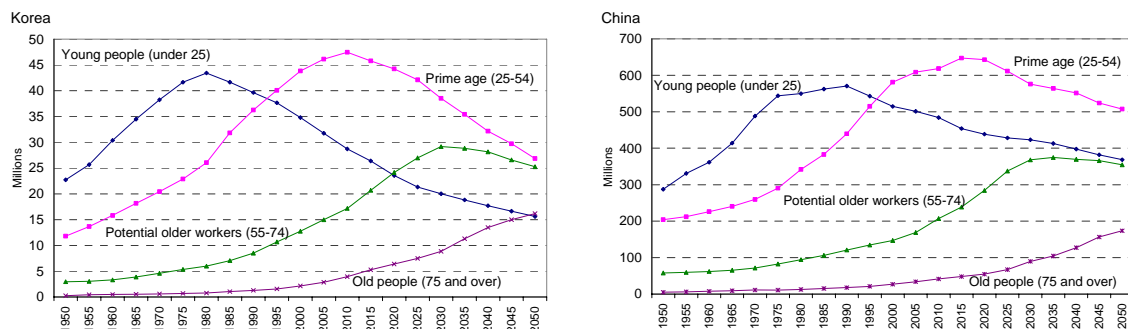
Singapore shares with Japan a pronounced future fall in prime age population - the number of persons aged 25-54 years is projected to fall by 26% by 2050 - but the most striking feature of its projected age distribution is the rapid rise in potential older workers between 2000 and 2025. Over that 25 years the number of persons aged 55-74 years will more than treble, growing by 2.7% per annum over that time. Just as Singapore's growth in past decades has been supported by a sharp increase in the population of prime working age, which more than trebled between 1970 and 2000, it is currently in the forefront of the challenge to preserve the health and activity of a growing cohort of potential older workers.

Trends within Developing Economies

Again there is considerable diversity in the ageing process within the developing economies of APEC, with rapidly growing East Asian economies such as Korea and China facing sharp structural changes while the process is more subdued in economies such as Vietnam and Indonesia. Korea in particular faces major adjustments in coming decades: while the prime working age population will continue to increase until 2010, it is projected to fall by 43% between 2010 and 2050. By 2050 the population aged 55-74 years will be about the same as that aged 25-54 years, so that the issue of the health and productivity of

potential workers in the 55-74 years age group will be acute. By 2050 also the number of young Koreans will be equal to the number aged 75 years and over, a remarkable change from 1990 when the ratio was 30:1.

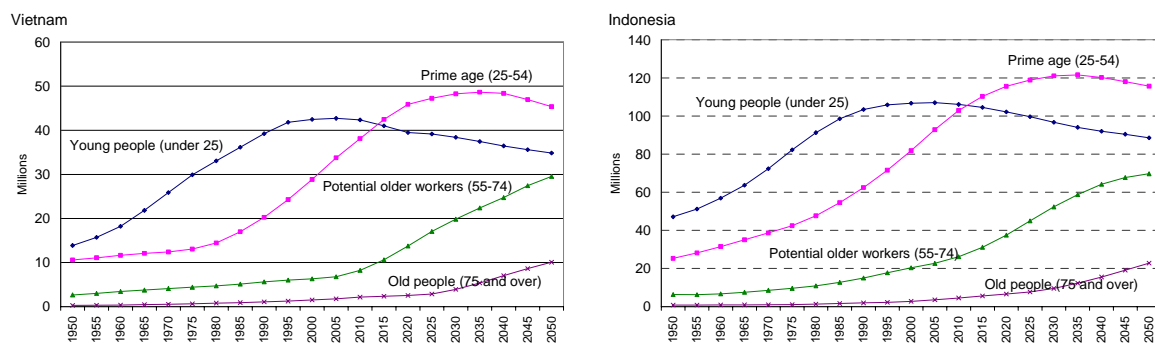
Figure 6. Population by broad age groups, China and Korea, 1950-2050



Source: Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

The ageing process in China is likely to be less dramatic than in Korea, but will still have major implications, especially given the scale involved. The number of young people in China began to decline after 1990, and will be 35% below the 1990 peak by 2050. The prime age population will continue to increase up to 2015, although more slowly after 2000 than the hectic pace (2.7% per annum) over 1970-2000, but will fall by 22% or 140 million between 2015 and 2050. China is about to experience very rapid growth in the population aged 55-74 years, which will double between 2005 and 2025 to 338 million, a growth rate of 3.7% per annum. The number of old people in China will gradually expand over the period to 2050, to reach 12.4% of the population at that time, much lower than the shares of 19.3% and 21.3% in Korea and Japan respectively.

Figure 7. Population by broad age groups, Vietnam and Indonesia, 1950-2050



Source: Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

Countries such as Vietnam and Indonesia face a much more gentle process of ageing than Korea or China (Figure 7). In both cases the number of young people peaks around 2005, but the number in the prime age 25-54 age group continues to rise until about 2035. As a result the prime age population is considerably higher in 2050 than in 2005, by 34% in Vietnam and 25% in Indonesia. Nevertheless the number of persons aged 55-74 years is projected to rise strongly in both countries (by 3.3% and 2.5% per annum respectively over 2005-50), as is the number of old people (by 3.9% and 4.2% respectively). However by 2050 old people

are expected to account for only 8.3% of the Vietnamese population and for 7.7% of the Indonesian population. Population data for a number of other APEC economies are provided in Tables 3 and 4 and for all APEC economies in Appendix Tables A5-A8.

4. Existing and Emerging Knowledge Resources for Innovation in Health Systems

A Wealth of Existing Knowledge Resources

As noted earlier, many countries have achieved great success in reducing both mortality and morbidity for a range of health problems that used to make up a large part of the burden of disease. Deaths from cardiovascular problems, for instance, while still the major cause of death, have been reduced markedly through a combination of health interventions. The key risk factors for many chronic diseases are well-known, and public health campaigns have been successful in reducing the incidence of tobacco smoking and alcohol consumption and in promoting improved nutrition and awareness of early detection of disease. Medical technologies, principally medicines aimed at controlling blood pressure and cholesterol levels but also improved surgical intervention, have been successful in preventing death and disability from heart attacks and strokes.

Aside from cardiovascular disease, medicines developed over the second half of the 20th Century have been successful in providing acceptable control for a wide range of common contributors to the disease burden. Vaccines have been developed to prevent common infectious diseases such as smallpox, tetanus and measles and influenza while conditions such as peptic ulcers, asthma, depression and bacterial infections are well controlled by existing medicines. Even major threats such as HIV/AIDS are now under control in many countries through active prevention campaigns and the development of better antiretroviral therapies that are easier to use. Increasingly these widely used medicines are reaching the end of their patent lives and generic suppliers are providing cheaper substitutes for originator brands, thus increasing affordability and enabling their wider use.

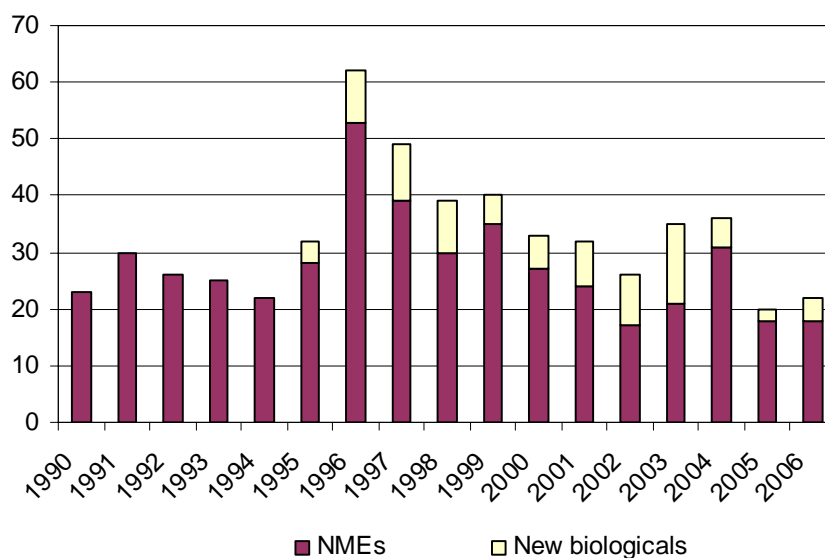
The Continuing Search for New Medicines and Treatments

Much more can be achieved by making more effectively use of existing knowledge, vaccines, medicines and other prevention and treatment strategies. Given this knowledge, attention has turned to the treatment of more intractable problems. Cancer has become more important as a cause of death and while improvements have been made in earlier detection and intervention, there is still a long way to go in curing cancers or achieving major extensions of life once cancer has been diagnosed. Similarly, the other diseases of old age such as dementia and arthritis are inadequately treated by existing medicines. Obesity and overweight associated with more sedentary lifestyles and inappropriate nutrition are of increasing concern because of a perceived link to type II diabetes and cardiovascular problems.

In response to these trends, about a quarter of pharmaceutical company R&D spending is now concentrated on treatments for cancer with increasing amounts being dedicated to medicines

for pain and arthritis, cognition enhancement, diabetes and ophthalmological diseases of old age (Pharmaprojects 2006). It is becoming increasingly apparent, however, that the usual approach by pharmaceutical companies to developing medicines to treat these conditions is not as productive as it used to be. Despite a large increase in spending on R&D, the

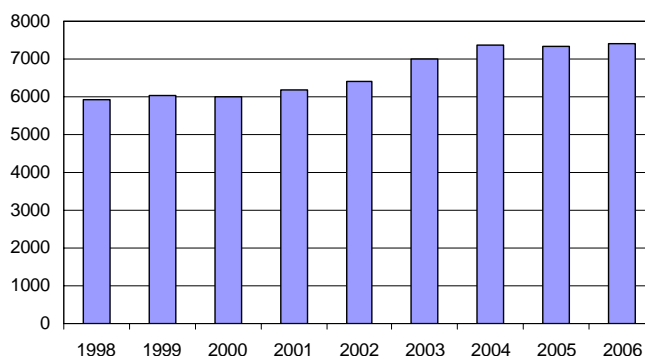
Figure 8. FDA approvals for new molecular entities and biologicals



Source: PAREXEL (2005), FDA (2007).

pharmaceutical pipeline has been declining, as shown by the decline in recent years in new molecular entities and biological drugs being approved by the FDA, from the peak levels of the second half of the 1990s (see Figure 8).

Figure 9. Number of drugs in active development



Source: Pharmaprojects (2006).

In part this reflects the fact that the easy targets to treat have been addressed and it is inherently more difficult to treat conditions such as cancer and dementia. Over the past ten years, companies have opened up a wider range of drug targets and potential drug candidates by complementing traditional drug discovery approaches built around small molecule drugs

with those based on biotechnology, most often through strategic alliances with dedicated biotechnology companies. This expanded strategy promises to provide better treatments for these difficult conditions, although there are still relatively few biotechnology medicines that treat widespread problems. The massive sources of genomic and proteomic data thrown up by breakthroughs in molecular biology have created more drug candidates in the early stages of the drug development pipeline. Figure 9 shows the significant increase in the number of drugs in development up to 2004, with a stabilisation over the past two years. Despite the promise of biotechnology-based drugs, there is accumulating evidence that the failure rates in the early stages, particularly in Phase 2 trials, have increased, resulting in fewer new drugs entering large-scale clinical tests and surviving to reach the market. To some extent this is reflected in the smaller number of biologicals approved in 2005 and 2006 after the rush of approvals over the previous 10 years.

Towards More Targeted Medicines

Successful treatment of disease is usually enhanced if the disease is recognised at an early stage. Sensitive diagnostics are being developed, using biotechnology and nanotechnology, both to detect the presence of disease conditions or predisposition to disease and to test for how well a patient will respond to particular treatments for disease in terms of both efficacy and side effects. This in turn will enable medicines to be better tailored to an individual patient's profile using pharmacogenomic techniques, so that medicines are more efficacious with fewer side effects. These developments in diagnostics combined with information technology should mean that they can be routinely deployed to test for a wide range of conditions and predispositions, if their cost can be kept within reasonable bounds. There are already drugs that are being made available to patients conditional on tests being undertaken that indicate whether the patient is likely to respond to the drug. One of the most widely known of these is Herceptin (trastuzumab), which is a medicine for the treatment of breast cancer that is superior to alternative treatments only for patients with proteins expressed by the HER2 gene, for which a specific diagnostic has been developed. The cost of a year's treatment with Herceptin in Australia is over A\$35,000.

The promise of this 'personalised' medicine and its impact on the economics of discovering, producing and distributing medicines has still to be determined, although researchers are beginning to develop the models and analysis that will contribute to a better understanding of this. Trusheim, Berndt and Douglas (2007) approach this subject by distinguishing between therapies that are truly personalised such as the cancer vaccine made from an individual patient's tumour cells that is only administered to that patient (see Box 1), and what they call 'stratified' medicine in which patients are matched to the most appropriate treatment using a clinical biomarker. They distinguish both from the traditional situation, which they call 'empirical' medicine, where treatments are not matched to patients or are matched on a hit-or-miss basis. In 'stratified' medicine there is a clinical biomarker that associates a treatment to a patient sub-population that has shown a differential and substantial clinical response. These biomarkers can take a variety of forms, including tests such as those used to detect proteins expressed by the HER2 gene or results from imaging or a doctor's perceptions.

Trusheim, Berndt and Douglas suggest that for many popular medicines, such as the statins for lowering blood cholesterol, it is unlikely that the differential response in patients will be large or important enough to warrant the cost of developing and using a biomarker to

optimise the treatment for individual patients. Weighing up various factors such as patient impact and size of market they identify arthritis and other autoimmune disease, and depression and other central nervous diseases as areas likely to attract 'stratified' medicines. The economic viability of producing these medicines relies on being able to charge a premium over conventional treatments both for the drug and the biomarker, even though some of the costs of developing both may be less than conventional drugs if clinical trials can be better targeted. The stratified medicines released to date are all expensive - the cost of a year's treatment with Herceptin in Australia is over A\$35,000, for instance - so there is a challenge to convince patients or third party payers that the premium is justified by superior performance, either as better efficacy and reduced side effects or through better compliance.

Box 1. Case study: Cancer vaccines

Vaccines have made an important contribution to reducing the overall burden of diseases in society by preventing the occurrence of numerous diseases that killed or seriously disabled large numbers of people in the past. Smallpox, polio, measles, mumps, rubella, diphtheria and tetanus are either non-existent or well controlled because of mass immunisation programs. Consequently, a lot of attention has been paid over the past few years to developing vaccines for diseases in developing countries such as malaria, HIV and TB; for diseases that might be used as bioweapons such as anthrax; and for newly emerging diseases such as SARS, West Nile virus and bird flu. Perhaps to some extent overlooked, however, is the fact that are vaccines being developed for conditions which are common causes of death and where it has proved difficult to achieve significant reductions in the burden of disease. Cancer is the main example of such as disease and there has been progress recently in developing vaccines to prevent and treat different forms of cancer.

Acting in a way similar to conventional vaccines, cancer vaccines aim to stimulate the body's immune system to recognise and attack specific cancer cells or the agents such as viruses that can lead to cancer. These vaccines can be either therapeutic, ie they treat cancer that already is present, or prophylactic in that they prevent cancer developing. A therapeutic vaccine for preventing hepatitis B (Engerix-B), which can lead to liver cancer, was first approved in 1998. More recently a vaccine for preventing infection by the two types of human papilloma virus responsible for 70% of cervical cancer (Gardasil) was approved in 2006 and is currently being deployed (NCI 2007). A second HPV vaccine (Ceverix) is due for release later in 2007. In March 2007 the US FDA recommended that another cancer vaccine (Provenge) be approved for treatment of prostate cancer while the French drug company Sanofi-Aventis has agreed to pay over 500 million Euros for a vaccine against renal cancer. The eventual market for HPV cancer vaccines alone is estimated by one analyst to reach US\$4 billion (Piribo 2007).

In all there are around 80 potential cancer vaccines in various stages of development around the world, with about 14 of these in Phase III clinical trials (Pijpers et al 2005; NCI 2007). These later stage vaccines are aimed at treating cervical cancer, Non-Hodgkin's lymphoma, kidney cancer, melanoma, prostate cancer, and multiple myeloma. While there are multiple strategies for developing these vaccines, the predominant one uses antigens or specific protein fragments found in tumour cells to stimulate the immune system, often combined with an adjuvant that enhances the immune response. While most of these vaccines are generalised in that they are designed for mass use, some cancer vaccine strategies are personalised and are hence more costly. These latter are based on antigens harvested from an individual patient and made up into a vaccine specific for that patient and a specific cancer. Provenge is an example of such a personalised vaccine and results have been encouraging for others in clinical trials.

The recent release of some cancer vaccines, the extent of the research being carried out into other possible vaccines and the results obtained to date suggest that cancer vaccines will have a significant impact on the burden of disease associated with cancer and could result in major savings in the cost of treating these important sources of disease.

Other treatment approaches besides medicines also hold out great promise in delivering better treatment for some major conditions. Stem cell therapy in particular is likely to enable replacement tissues and organs to be grown which can treat difficult conditions such as cystic fibrosis and other lung diseases, spinal cord injuries and others. Stem cell therapy is still in its infancy so it is difficult to estimate what its potential impact might be in terms of reducing both the disease burden and its associated health cost. In the USA estimates have been made on the impact on health expenditure in California (Baker and Deal 2004) and New Jersey (Seneca and Irving 2005). Both studies look at the application of stem cell therapy in 6 disease conditions – stroke, heart attack, type I diabetes, Parkinson’s disease, spinal cord injury and Alzheimer’s disease – and predicted savings to health expenditures in the two States of around \$11 billion each over a ten year period.

Meeting the Cost of New Treatments

Biotechnology-based drugs and these new kinds of treatment are often much more expensive than traditional treatments, reflecting the rising cost of discovering and proving new drugs and, in some cases, higher costs of production. This raises significant problems for all parties: for individuals who meet their own treatment costs, for government and other third party payers of medical care which seek to ensure equitable access to these treatments and for the companies that must finance the development of new treatments.

As the cost of medical treatments rise, there is greater use among payers of standard economic evaluation techniques such as cost-effectiveness analysis in making decisions on whether treatments should be supported and at what price. These techniques, the application of which to medicines was pioneered in Australia, are becoming increasingly widespread not only among government pharmaceutical insurance schemes but also among private insurers. Of the various types of economic evaluation widely used in different industries, only cost-benefit analysis (in which all costs and benefits are valued in dollars) can provide an absolute rather than a relative assessment, but it is of very limited application within health. The three types of evaluation widely used in relation to medicines (cost effectiveness analysis, cost-minimisation analysis and cost-utility analysis) are all inherently comparative, in that they compare the effectiveness, cost or contribution to utility of two drugs at a given set of prices.

Such methods can play a valuable role in comparing the effectiveness of two (or in some circumstances more than two) treatments at a given level of prices. But it is important to note that they are inherently comparative at a given level of prices. They do not set either the overall level of drug prices or the value assigned to a unit difference in effectiveness between two drugs, and other rules are required for these purposes (Drummond et al. 1997). One way in which the overall level of prices might be set is through so called ‘Ramsey’ pricing principles (Danzon and Towse 2003), through which the overall price level would reflect the standard of living in an economy and hence its ability to pay. However, the practical implementation of these approaches needs to overcome a number of hurdles, especially that of parallel trade.

The downward pressure on the price of medicines arising from the greater availability of generic medicines, the increasing expense in developing new medicines and the necessity to prove cost-effectiveness contribute to an environment in which it becomes more difficult for pharmaceutical companies to generate the returns necessary to support the cost of investing

in innovation. If, in a cost-effectiveness or reference pricing framework, the increasing availability of low cost generics is used to lower the average prices for new medicines, global investment in the next generation of treatments could be curtailed.

Renewed Emphasis on 'Developing Country' Diseases

Developing economies face the same challenges in providing adequate health care to their people as do other economies, but with fewer resources. In addition they face health problems that are either not present to the same extent in developed economies or are better controlled. The major problems are insect-borne diseases endemic in some tropical and semi-tropical regions such as malaria, dengue fever, leishmaniasis, trypanosomiasis, Chagas disease, schistosomiasis and diseases closely associated with poverty, such as tuberculosis, HIV/AIDS, pneumonia and hepatitis. For some of these diseases such as TB there are already effective treatments and the challenge is to be able to provide the medicines at an affordable price, and to deliver them to the individuals and communities that need them. For diseases such as HIV/AIDS the problem of cost is compounded by the necessity to have an adequate health infrastructure to ensure effective delivery and continuance of treatment.

Being able to control these diseases will make a major contribution to the ability of developing economies to achieve economic growth and improved living standards. While the WHO and individual economies have been active in developing programs for attacking disease in developing economies, much of the international activity has been undertaken by independent and non-government organisations. An example is the Global Fund to Fight AIDS, Tuberculosis and Malaria headquartered in Switzerland. The Global Fund aims to attract, manage and disburse resources to fight these diseases and has provided some US\$1.5 billion since its inception in 2002.

For those diseases of developing economies for which there are inadequate treatments, however, the difficulty has been to devise a mechanism that will provide an incentive for pharmaceutical companies to develop medicines at a price to at least cover the costs of development. The traditional system for developing new drugs has been to provide patent protection for new medicines enabling companies to charge prices above the marginal cost of production for long enough to recoup their development costs. Alternative mechanisms to patent protection have been proposed and discussed including funding new drug development through government agencies and replacing patents with prizes or rewards (Hollis 2005; Hubbard and Love 2004; DiMasi and Grabowski 2004).

The proposal that has gained most attention and support however is the idea of Advance Purchase Commitments (or Advanced Market Commitments) developed by a group of economists with links to the Center for Global Development at Harvard University (Barder et al. 2005; Kremer, Towse and Williams 2005; Towse and Kettler 2005; Berndt et al. 2005). This mechanism is aimed at encouraging pharmaceutical companies to undertake the R&D necessary to develop a new medicine. Sponsors such as international funding agencies would commit in advance of the product development taking place to fully or partially finance the purchase of a certain amount of the medicine at a pre-specified price. Developing economies would decide whether to buy the medicine at a particular price and the sponsor would guarantee to fund the difference between this price and the agreed price (Berndt et al. 2005). Sales of the medicine beyond the agreed amount would be at an affordable price.

The idea is based on the support already provided for the development of medicines for so-called 'orphan drugs' for diseases with fewer than 200,000 sufferers in the United States. It has been implemented in a limited way by the United Kingdom and the United States to spur the development of vaccines for meningitis C and anthrax (Towse and Kettler 2005). Transferable patent extensions have also been proposed as a mechanism for encouraging the development of developing country diseases.

A major study for the Wellcome Trust conducted by researchers at the London School of Economics (Moran et al. 2005) has identified over 60 projects that are aimed at developing medicines for the treatment of a number of disease common to developing economies such as malaria, tuberculosis and dengue fever. About half of these are undertaken by multinational pharmaceutical companies on a not-for-profit basis with the remainder being undertaken by smaller companies or research groups. Most projects are conducted under a Public-Private Partnership arrangement with the involvement of organisations such as the WHO and philanthropic funds.

All these projects are aimed at developing medicines to treat people who are already suffering from the disease being targeted. Once these medicines have been developed, there remains the problem of their cost and the necessity for an adequate health delivery infrastructure to ensure effective delivery. Attention therefore has turned increasingly to the development of vaccines to prevent people developing the disease in the first place.

Several major international initiatives such as the Global Alliance for Vaccines and Immunization supported by the Bill and Melinda Gates Foundation, the WHO and the World Bank among others are aimed at developing vaccines for malaria, tuberculosis and HIV/AIDS.

Over the course of the 20th Century great strides were made in the development of vaccines for common communicable diseases such as smallpox, polio, tuberculosis, influenza, diphtheria, measles, pertussis, and tetanus. Although the development of vaccines slowed in the latter part of the century other vaccines for hepatitis A and B, rabies, meningitis, pneumococcal disease and yellow fever also appeared on the market. Just in the past 12 months, new vaccines for rotavirus, human papilloma virus and herpes zoster (shingles) have been approved for use.

The renewed interest in vaccines has seen their importance grow in recent years. The Pharmaprojects database, for instance reports, that there are some 341 active vaccine R&D projects at the moment, an increase of 29% over the past 6 years (Pharmaprojects 2006). The potential benefits of the renewed emphasis on vaccines are illustrated for the case of cancer vaccines in the case study in Box 1 above.

5. Investment in Cost-effective Innovation in Health

This paper has sought to bring out a number of key main points. First, that the member economies of APEC face significant health challenges in the decades ahead. While communicable diseases, including HIV/AIDS, remain a serious problem, the central health issue is that all economies face a rapid rise in chronic diseases such as cancer, diabetes and

cardiovascular and respiratory diseases. The rise in chronic diseases will cause suffering and premature loss of life; they are also costly to diagnose and treat, and will impose new pressures on health budgets. Secondly, at the same time sharp changes are taking place in the age structure of the population of the APEC region – there will be no growth in the prime working age population over 2005-50 but an increase of 670 million persons aged 55 years and over. This will mean slower workforce and economic growth, together with rising demands on pension and social security systems.

Thirdly, this combination of increasing chronic disease and rapid population ageing provides an unprecedented challenge to many economies, An essential element in the response to this challenge to growth, health policy and financial sustainability will need to be substantial but well-planned investments in health innovation, perhaps of a scale not previously contemplated in the region. Fourthly, there is now a vast repository of existing medical knowledge and of proven technologies available for use in APEC economies, and there are also major new scientific and medical developments in progress in many relevant areas. Thus existing and emerging knowledge can provide the basis for such investments, if it can be utilised efficiently in the setting of each individual economy.

These conclusions imply that the task presented to policy makers by these challenges is to find the pattern and scale of cost-effective innovation, having regard to the specific needs and circumstances of each economy, which will provide the best outcome in terms of health, development and fiscal sustainability. By innovation we mean the creation and use of knowledge new to the specific context in which it is applied, across all dimensions of the health system, from new medicines and advanced treatments to policy frameworks, insurance arrangements, rural and urban infrastructure and governance structures. In this section we make some concluding comments on aspects of the required investment in innovation.

Investing Wisely in Health Innovation

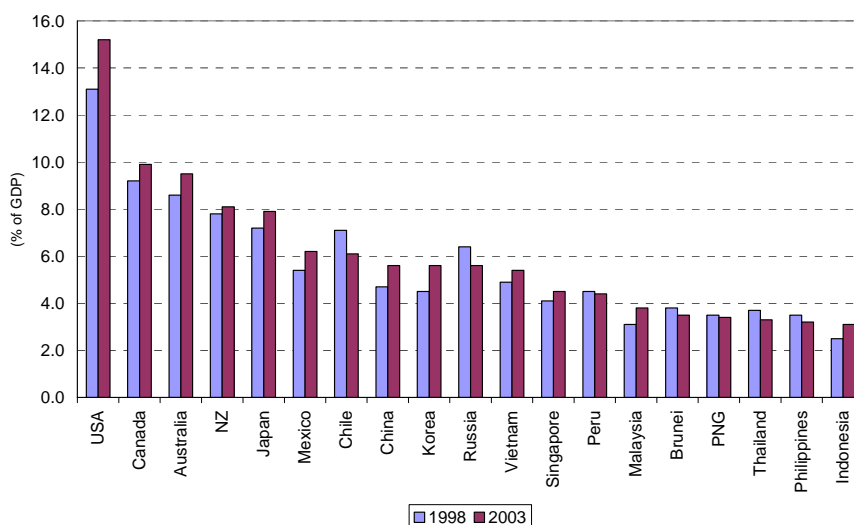
In considering the nature and scale of this investment, it is necessary to have a clear view of the stakes involved. In 2005 WHO proposed, as a target for addressing the global rise in chronic disease, an additional 2% reduction per annum in death rates from chronic disease over the period 2005-2015 (WHO 2005; Knight et al 2005). This target was measured relative to their projected death rates, and was argued to be achievable in the light of the reduction in various chronic disease rates that had been achieved in a range of countries.

Here we examine a longer term but somewhat lower target, that death rates from chronic disease in APEC could be reduced by an additional 1.5% per annum from 2010 to 2030 (relative to the WHO projection). This would mean that deaths from chronic diseases in the region would be about 6 million lower in 2030 than projected. Some 60 million deaths would be averted over this period of twenty years, about 90% of which would be in the developing economies, and over half in people less than 70 years of age. For those people, the loss of over 800 million disability-adjusted life years would be averted over the period. As a death from chronic disease is often the end point of prolonged and expensive treatment, the gross savings to health budgets could be large, while the potential labour force would be substantially increased.

Not every potential health innovation will be financially or socially cost-effective and each needs to be individually assessed on own merits, on a comprehensive assessment of the costs and benefits. But there is growing evidence that many innovations generate both long-term economic and social benefits and direct financial benefits to public budgets taken as a whole. Other innovations will remain socially beneficial but still have a net cost to the public purse. What is unique about the present situation in many APEC economies is that severe population ageing provides a direct link between health outcomes and growth in labour force and economic output, thereby strongly leveraging the benefits from effective health policy.

Figure 10 illustrates diversity of levels of spending on health across the APEC economies, with spending as a share of GDP generally related to GDP per capita levels. Given the health challenges outlined above, and the growing medical and technological resources available to economies to address them, there appears to be a persuasive economic case for devoting increased resources to health in many APEC economies. This is especially so for economies which have achieved rapid growth through a focus on industrial development, with low levels of health spending and increasing inequality of access to health services. It is likely that such economies could now achieve more rapid increases in the welfare of their populations by placing greater priority on health services and their distribution.

Figure 10. Health spending as a share of GDP, selected APEC economies, 1998 and 2003



Source: World Bank

In some developing countries, inequality in access to health services has been exacerbated by the high reliance on private resources for health financing. A case in point is China, where about two thirds of health costs are met privately. This heavy reliance on meeting health costs from private incomes is common to some other developing countries (eg Indonesia, Vietnam and the Philippines, where less than 30% of health costs are met by the public sector). It contrasts sharply with the situation in developed countries – the USA is the only OECD country for which more than 50% of health costs are met privately – and is the most notable difference in funding structure between the two groups of economies.

Key Role for Prevention, Early Detection and Early Intervention

Given the human, economic and financial costs of chronic diseases, there is a strong case for increased investment in prevention and early detection and intervention. Here we refer to activities across the whole spectrum: improved sanitation and living conditions in poor areas; prevention programs, including lifestyle changes and preventive medicine based on known risk factors (such smoking, alcohol use, obesity and blood lipid levels) and systematic monitoring of such risk factors; expanded vaccination programs, with older proven vaccines or new ones in the pipeline; and advanced screening and biomarker projects to identify and treat the preconditions for disease. This applies both to the developed economies, where much chronic disease could still be averted by early action, and to the developing economies, many of whom have not yet had the time or resources to build appropriate programs.

Finding the Right Balance

In encouraging increased investment in health innovation it will be necessary to find the right balance in many areas: between the use of public and private resources; between providing an appropriate return for innovation and delivering accessible, high quality services to the whole population at an affordable cost; between cost-effectiveness analysis and reliance on market forces, and so on. For example, especially in large and diverse economies, with significant income dispersion and geographical variation, a strong public infrastructure and financing framework may be necessary to ensure that more recent innovations are available widely throughout the population. On the other hand, given the nature of the challenges and varieties of innovations available, a significant role for private funding and for market forces will also be necessary.

A case in point is the utilisation of public-private partnerships. All economies, however rich or poor, face the challenge of building enhanced domestic capability to be able to participate in and benefit from continued progress in the life sciences and to meet the challenge of chronic diseases and ageing populations. In this process it will be necessary both to marshal public resources and to draw on private funding, and properly designed public-private partnerships can play a significant role.

The Need for an Integrated Approach

The new centrality of health policy to both economic outcomes and to financial sustainability is a fundamental fact of the 21st Century. Much will depend, for both economic growth and health budgets, on the wellbeing of large cohorts of people as they age. If effective health innovation allows them to remain healthy and active, labour supply will increase and future health and pension costs will be contained, even as the growth dividend provides more resources to meet those health costs. But if effective innovation is not achieved, high health and pension costs will be a drag on economies with limited ability to generate additional resources to meet these costs.

This effective innovation will not be achieved by economic or finance experts or by health professionals working alone, or by government or business independently of one another. To achieve cost-effective innovation, meeting the specific needs of each economy, an integrated approach is required, bringing together expertise in health policy and management, economic

and financial analysis and science and technology from government, academia and the business community.

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Table A1. Burden of disease in APEC developed economies 2005 and 2030, disability-adjusted life years (DALYs) lost by cause

| Disease | 2005 | | | | | | | 2030 | | | | | | | Per cent change in totals (%) |
|--|-------|--------|--------|-------|-------|-------|--------|-------|--------|--------|--------|--------|-------|--------|-------------------------------|
| | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Total | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Totals | |
| All causes | 5,299 | 12,343 | 28,195 | 9,725 | 8,232 | 4,983 | 68,777 | 3,715 | 11,759 | 23,085 | 10,597 | 11,471 | 8,029 | 68,656 | -0.2 |
| Communicable, maternal, perinatal and nutritional | 1,201 | 539 | 1,031 | 231 | 292 | 276 | 3,570 | 475 | 262 | 600 | 148 | 270 | 339 | 2,094 | -41.3 |
| Infectious and parasitic diseases | 281 | 330 | 805 | 137 | 124 | 64 | 1,741 | 121 | 188 | 508 | 89 | 127 | 78 | 1,112 | -36.1 |
| Respiratory infections | 92 | 29 | 144 | 94 | 168 | 213 | 739 | 33 | 16 | 73 | 59 | 143 | 261 | 586 | -20.8 |
| Maternal, perinatal, nutritional | 1,832 | 734 | 455 | 76 | 57 | 34 | 3,187 | 357 | 204 | 108 | 30 | 33 | 19 | 752 | -76.4 |
| Noncommunicable diseases | 3,272 | 9,242 | 24,142 | 9,113 | 7,698 | 4,575 | 58,042 | 2,807 | 9,304 | 20,161 | 10,055 | 10,866 | 7,455 | 60,647 | 4.5 |
| Neoplasms | 108 | 241 | 4,300 | 2,553 | 1,942 | 628 | 9,772 | 55 | 169 | 3,036 | 2,656 | 2,495 | 1,011 | 9,422 | -3.6 |
| Diabetes mellitus | 6 | 76 | 1,425 | 443 | 312 | 130 | 2,392 | 5 | 121 | 1,919 | 704 | 731 | 304 | 3,784 | 58.2 |
| Endocrine disorders | 124 | 153 | 527 | 101 | 92 | 68 | 1,067 | 69 | 121 | 361 | 106 | 141 | 109 | 907 | -15.0 |
| Neuropsychiatric conditions | 1,264 | 7,502 | 7,132 | 1,131 | 1,108 | 1,116 | 19,254 | 1,206 | 7,825 | 7,125 | 1,564 | 1,764 | 2,048 | 21,533 | 11.8 |
| Sense organ diseases | 1 | 43 | 1,763 | 889 | 518 | 117 | 3,331 | 1 | 35 | 1,671 | 1,227 | 811 | 216 | 3,961 | 18.9 |
| Cardiovascular diseases | 76 | 230 | 3,651 | 2,108 | 2,183 | 1,678 | 9,927 | 54 | 150 | 2,073 | 1,762 | 2,719 | 2,348 | 9,107 | -8.3 |
| Respiratory diseases | 623 | 564 | 1,672 | 650 | 604 | 321 | 4,434 | 613 | 545 | 865 | 527 | 699 | 459 | 3,709 | -16.4 |
| Digestive diseases | 90 | 120 | 1,410 | 387 | 312 | 199 | 2,518 | 26 | 53 | 1,067 | 385 | 535 | 402 | 2,467 | -2.0 |
| Musculoskeletal diseases | 64 | 165 | 1,603 | 573 | 397 | 141 | 2,943 | 64 | 154 | 1,522 | 789 | 622 | 258 | 3,409 | 15.8 |
| Other | 916 | 148 | 658 | 277 | 228 | 178 | 2,405 | 714 | 130 | 522 | 335 | 349 | 300 | 2,351 | -2.3 |
| Injuries | 737 | 2,286 | 2,836 | 342 | 214 | 115 | 6,531 | 397 | 2,046 | 2,235 | 363 | 302 | 216 | 5,559 | -14.9 |
| Unintentional injuries | 630 | 1,506 | 1,701 | 234 | 174 | 105 | 4,350 | 284 | 1,088 | 994 | 227 | 245 | 196 | 3,033 | -30.3 |
| Intentional injuries | 107 | 781 | 1,135 | 108 | 40 | 10 | 2,181 | 113 | 958 | 1,241 | 136 | 57 | 20 | 2,526 | 15.8 |

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

Table A2. Burden of disease in APEC developing economies 2005 and 2030, disability-adjusted life years (DALYs) lost by cause

| Disease | 2005 | | | | | | | 2030 | | | | | | | Per cent change in totals (%) |
|--|--------|--------|---------|--------|--------|-------|---------|--------|--------|---------|--------|--------|--------|---------|-------------------------------|
| | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Total | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Total | |
| All Causes | 65,733 | 66,140 | 140,756 | 38,978 | 27,958 | 9,115 | 348,680 | 26,031 | 54,260 | 141,072 | 59,894 | 44,384 | 17,699 | 343,340 | -1.5 |
| Communicable, maternal, perinatal & nutritional | 30,327 | 9,806 | 14,019 | 1,920 | 1,262 | 510 | 57,843 | 6,908 | 10,251 | 18,732 | 1,476 | 950 | 579 | 38,896 | -32.8 |
| Infectious and parasitic diseases | 9,596 | 6,798 | 11,612 | 1,399 | 770 | 176 | 30,351 | 1,952 | 9,681 | 17,962 | 1,107 | 468 | 168 | 31,339 | 3.3 |
| Respiratory infections | 4,903 | 647 | 1,419 | 521 | 492 | 334 | 8,315 | 518 | 205 | 607 | 369 | 482 | 411 | 2,592 | -68.8 |
| Maternal, Perinatal, Nutritional | 19,023 | 3,301 | 1,880 | 117 | 64 | 30 | 24,416 | 5,326 | 641 | 499 | 81 | 63 | 36 | 6,647 | -72.8 |
| Noncommunicable diseases | 22,425 | 36,794 | 104,168 | 35,070 | 25,778 | 8,359 | 232,594 | 13,456 | 28,781 | 103,109 | 55,240 | 41,845 | 16,574 | 259,005 | 11.4 |
| Neoplasms | 989 | 1,529 | 16,671 | 6,657 | 3,871 | 657 | 30,374 | 604 | 980 | 17,383 | 12,333 | 7,206 | 1,588 | 40,093 | 32.0 |
| Other neoplasms | 70 | 47 | 192 | 48 | 30 | 6 | 394 | 40 | 30 | 192 | 83 | 55 | 15 | 414 | 5.2 |
| Diabetes mellitus | 47 | 337 | 3,029 | 1,087 | 665 | 134 | 5,298 | 25 | 268 | 4,277 | 2,175 | 1,478 | 357 | 8,580 | 62.0 |
| Endocrine disorders | 787 | 319 | 615 | 102 | 66 | 35 | 1,924 | 266 | 176 | 536 | 156 | 116 | 72 | 1,323 | -31.3 |
| Neuropsychiatric conditions | 7,772 | 25,600 | 22,090 | 2,280 | 1,607 | 829 | 60,179 | 5,595 | 21,694 | 23,160 | 4,634 | 3,009 | 1,867 | 59,959 | -0.4 |
| Sense organ diseases | 50 | 941 | 17,213 | 5,469 | 2,276 | 406 | 26,354 | 35 | 720 | 18,875 | 9,949 | 4,179 | 936 | 34,694 | 31.6 |
| Cardiovascular diseases | 700 | 1,944 | 19,268 | 11,600 | 10,978 | 3,965 | 48,455 | 383 | 890 | 13,256 | 12,389 | 14,472 | 6,527 | 47,916 | -1.1 |
| Respiratory diseases | 2,041 | 1,648 | 6,275 | 3,733 | 4,163 | 1,731 | 19,590 | 1,621 | 1,376 | 7,623 | 6,900 | 7,865 | 3,990 | 29,375 | 49.9 |
| Digestive diseases | 2,118 | 1,468 | 7,128 | 1,571 | 1,032 | 325 | 13,642 | 440 | 510 | 5,650 | 1,937 | 1,552 | 615 | 10,704 | -21.5 |
| Musculoskeletal diseases | 425 | 1,479 | 7,694 | 1,434 | 541 | 119 | 11,693 | 356 | 1,196 | 8,113 | 2,807 | 977 | 268 | 13,717 | 17.3 |
| Other | 7,496 | 1,529 | 4,185 | 1,137 | 579 | 158 | 15,084 | 4,130 | 972 | 4,237 | 1,960 | 991 | 353 | 12,643 | -16.2 |
| Injuries | 9,786 | 18,600 | 21,678 | 1,871 | 853 | 217 | 53,005 | 4,779 | 14,952 | 18,894 | 3,097 | 1,526 | 510 | 43,758 | -17.4 |
| Unintentional injuries | 9,092 | 12,726 | 14,578 | 1,284 | 599 | 172 | 38,450 | 4,187 | 9,396 | 11,398 | 1,976 | 1,070 | 405 | 28,433 | -26.1 |
| Intentional injuries | 694 | 5,875 | 7,100 | 587 | 254 | 45 | 14,555 | 592 | 5,556 | 7,495 | 1,120 | 456 | 105 | 15,325 | 5.3 |

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

Table A3. Death in APEC developed economies 2005 and 2030, thousands

| Disease | 2005 | | | | | | | 2030 | | | | | | | Per cent change in totals (%) |
|--|------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|--------|-------------------------------|
| | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Total | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Totals | |
| All Causes | 51 | 72 | 651 | 596 | 1,032 | 1,852 | 4,254 | 26 | 64 | 457 | 574 | 1,348 | 2,767 | 5,236 | 23.1 |
| Communicable, maternal, perinatal & nutritional | | | | | | | | | | | | | | | |
| Infectious and parasitic diseases | 20 | 3 | 35 | 23 | 57 | 165 | 304 | 7 | 2 | 22 | 14 | 52 | 202 | 300 | -1.4 |
| Respiratory infections | 2 | 2 | 27 | 13 | 22 | 33 | 98 | 0 | 1 | 19 | 8 | 22 | 40 | 91 | -7.5 |
| Maternal, perinatal, nutritional | 1 | 1 | 7 | 10 | 33 | 125 | 176 | 0 | 0 | 3 | 6 | 28 | 153 | 191 | 8.3 |
| Noncommunicable diseases | 18 | 0 | 1 | 1 | 2 | 8 | 30 | 7 | 0 | 0 | 0 | 2 | 8 | 18 | -39.6 |
| Neoplasms | 21 | 21 | 502 | 543 | 941 | 1,636 | 3,664 | 13 | 16 | 342 | 528 | 1,250 | 2,472 | 4,620 | 26.1 |
| Other neoplasms | 3 | 6 | 221 | 251 | 347 | 318 | 1,146 | 1 | 4 | 157 | 259 | 442 | 509 | 1,373 | 19.8 |
| Diabetes mellitus | 0 | 0 | 4 | 4 | 8 | 14 | 30 | 0 | 0 | 3 | 4 | 11 | 22 | 41 | 34.7 |
| Endocrine disorders | 0 | 1 | 23 | 25 | 41 | 50 | 140 | 0 | 1 | 30 | 41 | 97 | 117 | 287 | 105.7 |
| Neuropsychiatric conditions | 1 | 1 | 8 | 5 | 9 | 20 | 45 | 1 | 1 | 6 | 6 | 13 | 32 | 59 | 30.5 |
| Cardiovascular diseases | 2 | 4 | 25 | 15 | 39 | 134 | 219 | 1 | 3 | 18 | 16 | 63 | 214 | 315 | 44.1 |
| Respiratory diseases | 2 | 5 | 150 | 170 | 350 | 830 | 1,507 | 1 | 3 | 79 | 135 | 426 | 1,143 | 1,789 | 18.7 |
| Digestive diseases | 1 | 1 | 18 | 36 | 87 | 145 | 288 | 1 | 1 | 10 | 29 | 100 | 202 | 342 | 18.8 |
| Genitourinary diseases | 1 | 1 | 42 | 26 | 35 | 62 | 167 | 0 | 0 | 32 | 26 | 60 | 125 | 243 | 45.7 |
| Musculoskeletal diseases | 0 | 0 | 8 | 10 | 24 | 61 | 103 | 0 | 0 | 4 | 10 | 35 | 102 | 152 | 47.4 |
| Other | 0 | 0 | 4 | 3 | 7 | 12 | 27 | 0 | 0 | 3 | 4 | 10 | 20 | 37 | 39.2 |
| Injuries | 10 | 1 | 3 | 1 | 2 | 5 | 24 | 7 | 1 | 2 | 2 | 3 | 9 | 24 | 2.7 |
| Unintentional injuries | 10 | 49 | 114 | 30 | 34 | 50 | 287 | 6 | 47 | 93 | 31 | 46 | 93 | 316 | 10.2 |
| Intentional injuries | 8 | 29 | 61 | 19 | 26 | 45 | 188 | 4 | 22 | 34 | 17 | 35 | 83 | 196 | 4.1 |
| Intentional injuries | 2 | 20 | 53 | 12 | 7 | 5 | 99 | 2 | 25 | 58 | 15 | 11 | 10 | 121 | 22 |

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

Table A4. Death in APEC developing economies 2005 and 2030, thousands

| Disease | 2005 | | | | | | | 2030 | | | | | | | Per cent change in totals (%) |
|--|-------|-------|-------|-------|-------|-------|--------|------|-------|-------|-------|-------|-------|--------|-------------------------------|
| | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Total | 0-14 | 15-29 | 30-59 | 60-69 | 70-79 | 80+ | Total | |
| All Causes | 1,129 | 679 | 3,777 | 2,735 | 4,068 | 3,400 | 15,787 | 334 | 608 | 3,746 | 3,839 | 6,200 | 6,336 | 21,063 | 33.4 |
| Communicable, maternal, perinatal & nutritional | 722 | 133 | 490 | 179 | 221 | 231 | 1,975 | 153 | 203 | 740 | 134 | 162 | 264 | 1,656 | -16.2 |
| Infectious and parasitic diseases | 214 | 102 | 392 | 118 | 119 | 62 | 1,007 | 35 | 195 | 704 | 92 | 63 | 58 | 1,147 | 13.9 |
| Respiratory infections | 119 | 17 | 70 | 55 | 94 | 155 | 509 | 11 | 5 | 29 | 39 | 91 | 190 | 365 | -28.3 |
| Maternal, perinatal, nutritional | 389 | 14 | 28 | 6 | 8 | 13 | 458 | 108 | 3 | 7 | 3 | 7 | 16 | 143 | -68.7 |
| Noncommunicable diseases | 249 | 161 | 2,448 | 2,381 | 3,708 | 3,085 | 12,033 | 108 | 85 | 2,255 | 3,420 | 5,793 | 5,876 | 17,536 | 45.7 |
| Neoplasms | 27 | 44 | 919 | 715 | 741 | 301 | 2,747 | 17 | 28 | 994 | 1,323 | 1,379 | 724 | 4,464 | 62.5 |
| Other neoplasms | 2 | 1 | 11 | 5 | 6 | 3 | 28 | 1 | 1 | 11 | 9 | 11 | 7 | 40 | 41.1 |
| Diabetes mellitus | 1 | 3 | 78 | 90 | 106 | 53 | 330 | 0 | 3 | 127 | 183 | 240 | 144 | 696 | 110.9 |
| Endocrine disorders | 16 | 5 | 16 | 6 | 8 | 12 | 63 | 5 | 3 | 15 | 9 | 14 | 26 | 72 | 13.4 |
| Neuropsychiatric conditions | 9 | 15 | 68 | 24 | 50 | 68 | 234 | 4 | 9 | 59 | 35 | 82 | 134 | 323 | 37.8 |
| Cardiovascular diseases | 16 | 44 | 906 | 1,063 | 1,886 | 1,753 | 5,668 | 9 | 19 | 611 | 1,075 | 2,423 | 2,834 | 6,973 | 23.0 |
| Respiratory diseases | 13 | 8 | 150 | 302 | 710 | 748 | 1,931 | 7 | 5 | 193 | 558 | 1,337 | 1,714 | 3,814 | 97.5 |
| Digestive diseases | 48 | 19 | 218 | 117 | 131 | 94 | 627 | 10 | 7 | 180 | 144 | 193 | 178 | 712 | 13.4 |
| Genitourinary diseases | 6 | 12 | 75 | 56 | 66 | 47 | 262 | 2 | 5 | 60 | 82 | 108 | 102 | 358 | 36.4 |
| Musculoskeletal diseases | 1 | 2 | 9 | 5 | 6 | 6 | 29 | 0 | 1 | 8 | 7 | 11 | 13 | 40 | 39.5 |
| Other | 113 | 9 | 9 | 3 | 3 | 4 | 141 | 54 | 5 | 8 | 4 | 6 | 9 | 85 | -39.5 |
| Injuries | 158 | 384 | 839 | 175 | 139 | 83 | 1,778 | 73 | 320 | 751 | 285 | 246 | 196 | 1,871 | 5.2 |
| Unintentional injuries | 148 | 241 | 537 | 113 | 92 | 63 | 1,195 | 65 | 186 | 427 | 167 | 162 | 150 | 1,158 | -3.1 |
| Intentional injuries | 9 | 143 | 303 | 62 | 47 | 20 | 584 | 8 | 134 | 323 | 118 | 84 | 46 | 713 | 22.2 |

Source: Unpublished WHO data consistent with Mathers and Loncar (2006).

Table A5. Population in APEC economies, 1960, 2005 and 2050, by age groups, thousand persons

| | 1960 | | | | | 2005 | | | | | 2050 | | | | |
|----------------------|-------------------------|-------------------|---------------------------------|----------------------|-------------|-------------------------|-------------------|---------------------------------|----------------------|-------------|-------------------------|-------------------|---------------------------------|----------------------|-------------|
| | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Grand total | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Grand total | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Grand total |
| Australia | 4534 | 4024 | 1443 | 275 | 10276 | 6774 | 8683 | 3588 | 1266 | 20311 | 7768 | 10106 | 6246 | 3921 | 28041 |
| Brunei | 48 | 27 | 6 | 1 | 82 | 177 | 168 | 25 | 3 | 373 | 214 | 290 | 134 | 42 | 680 |
| Canada | 8614 | 6679 | 2140 | 475 | 17908 | 10033 | 14454 | 5792 | 1992 | 32271 | 11253 | 15093 | 10174 | 6233 | 42753 |
| Chile | 4343 | 2483 | 713 | 105 | 7644 | 6838 | 6860 | 2059 | 536 | 16293 | 5787 | 7530 | 4881 | 2459 | 20657 |
| China | 361450 | 226253 | 61959 | 7829 | 657491 | 501155 | 608594 | 169023 | 34207 | 1312979 | 368568 | 507433 | 354679 | 178167 | 1408847 |
| Hong Kong | 1613 | 1227 | 215 | 19 | 3074 | 1974 | 3595 | 1111 | 378 | 7058 | 1759 | 3072 | 2403 | 1745 | 8979 |
| Indonesia | 56916 | 31488 | 6657 | 869 | 95930 | 106993 | 92831 | 22682 | 3555 | 226061 | 88524 | 115645 | 69686 | 23029 | 296884 |
| Japan | 46177 | 35899 | 10373 | 1646 | 94095 | 31868 | 52036 | 32635 | 11357 | 127896 | 19978 | 31415 | 27243 | 23876 | 102512 |
| Malaysia | 5110 | 2407 | 518 | 104 | 8139 | 12970 | 10102 | 2241 | 342 | 25655 | 12178 | 16106 | 8549 | 2797 | 39630 |
| Mexico | 24033 | 10841 | 2616 | 387 | 37877 | 51073 | 41076 | 9718 | 2400 | 104267 | 37371 | 49834 | 31120 | 13951 | 132276 |
| NZ | 2230 | 1728 | 630 | 156 | 4744 | 2932 | 3436 | 1360 | 466 | 8194 | 2868 | 3740 | 2372 | 1438 | 10418 |
| PNG | 2566 | 1322 | 240 | 32 | 4160 | 7282 | 4114 | 678 | 68 | 12142 | 9030 | 9668 | 3066 | 546 | 22310 |
| Peru | 12222 | 5988 | 1492 | 160 | 19862 | 27968 | 20450 | 5026 | 1102 | 54546 | 24634 | 31044 | 16738 | 5682 | 78098 |
| Philippines | 34852 | 15396 | 3382 | 478 | 54108 | 94892 | 59530 | 12848 | 1860 | 169130 | 94856 | 118504 | 53356 | 14222 | 280938 |
| Korea | 30374 | 15824 | 3318 | 494 | 50010 | 31754 | 46120 | 14992 | 2878 | 95744 | 15620 | 26868 | 25266 | 16904 | 84658 |
| Russia | 55339 | 48153 | 13762 | 2652 | 119906 | 46275 | 64891 | 25347 | 7438 | 143951 | 27049 | 39013 | 30854 | 10917 | 107833 |
| Singapore | 990 | 542 | 92 | 10 | 1634 | 1397 | 2136 | 662 | 133 | 4328 | 1025 | 1580 | 1368 | 1051 | 5024 |
| Thailand | 17121 | 8421 | 1857 | 253 | 27652 | 23771 | 29114 | 8401 | 1719 | 63005 | 18209 | 24742 | 16548 | 7879 | 67378 |
| USA | 82698 | 70070 | 27547 | 5844 | 186159 | 105176 | 127579 | 49021 | 18070 | 299846 | 117706 | 152519 | 86207 | 45985 | 402417 |
| Viet Nam | 18209 | 11646 | 3430 | 363 | 33648 | 42707 | 33752 | 6783 | 1786 | 85028 | 34828 | 45355 | 29542 | 10244 | 119969 |
| Developed economies | 175617 | 134766 | 45543 | 8900 | 364826 | 189934 | 254444 | 108050 | 36162 | 588590 | 176218 | 241321 | 158876 | 99408 | 675823 |
| Developing economies | 593822 | 365652 | 96847 | 13252 | 1069573 | 924075 | 975077 | 265942 | 55394 | 2220488 | 723007 | 968236 | 621556 | 271680 | 2584479 |
| All APEC | 769439 | 500418 | 142390 | 22152 | 1434399 | 1114009 | 1229521 | 373992 | 91556 | 2809078 | 899225 | 1209557 | 780432 | 371088 | 3260302 |

Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

Table A6. Population in APEC economies, 1960, 2005 and 2050, by age groups, percentage share

| | 1960 | | | | | 2005 | | | | | 2050 | | | | |
|----------------------|------------------------------------|-------------------|---------------------------------|----------------------|-------------|------------------------------------|-------------------|---------------------------------|----------------------|-------------|------------------------------------|-------------------|---------------------------------|----------------------|-------------|
| | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Grand total | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Grand total | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Grand total |
| | (per cent of total population - %) | | | | | (per cent of total population - %) | | | | | (per cent of total population - %) | | | | |
| Australia | 44.1 | 39.2 | 14.0 | 2.7 | 100 | 33.4 | 42.8 | 17.7 | 6.2 | 100 | 27.7 | 36.0 | 22.3 | 14.0 | 100 |
| Brunei | 58.5 | 32.9 | 7.3 | 1.2 | 100 | 47.5 | 45.0 | 6.7 | 0.8 | 100 | 31.5 | 42.6 | 19.7 | 6.2 | 100 |
| Canada | 48.1 | 37.3 | 11.9 | 2.7 | 100 | 31.1 | 44.8 | 17.9 | 6.2 | 100 | 26.3 | 35.3 | 23.8 | 14.6 | 100 |
| Chile | 56.8 | 32.5 | 9.3 | 1.4 | 100 | 42.0 | 42.1 | 12.6 | 3.3 | 100 | 28.0 | 36.5 | 23.6 | 11.9 | 100 |
| China | 55.0 | 34.4 | 9.4 | 1.2 | 100 | 38.2 | 46.4 | 12.9 | 2.6 | 100 | 26.2 | 36.0 | 25.2 | 12.6 | 100 |
| Hong Kong | 52.5 | 39.9 | 7.0 | 0.6 | 100 | 28.0 | 50.9 | 15.7 | 5.4 | 100 | 19.6 | 34.2 | 26.8 | 19.4 | 100 |
| Indonesia | 59.3 | 32.8 | 6.9 | 0.9 | 100 | 47.3 | 41.1 | 10.0 | 1.6 | 100 | 29.8 | 39.0 | 23.5 | 7.8 | 100 |
| Japan | 49.1 | 38.2 | 11.0 | 1.7 | 100 | 24.9 | 40.7 | 25.5 | 8.9 | 100 | 19.5 | 30.6 | 26.6 | 23.3 | 100 |
| Malaysia | 62.8 | 29.6 | 6.4 | 1.3 | 100 | 50.6 | 39.4 | 8.7 | 1.3 | 100 | 30.7 | 40.6 | 21.6 | 7.1 | 100 |
| Mexico | 63.5 | 28.6 | 6.9 | 1.0 | 100 | 49.0 | 39.4 | 9.3 | 2.3 | 100 | 28.3 | 37.7 | 23.5 | 10.5 | 100 |
| NZ | 47.0 | 36.4 | 13.3 | 3.3 | 100 | 35.8 | 41.9 | 16.6 | 5.7 | 100 | 27.5 | 35.9 | 22.8 | 13.8 | 100 |
| PNG | 61.7 | 31.8 | 5.8 | 0.8 | 100 | 60.0 | 33.9 | 5.6 | 0.6 | 100 | 40.5 | 43.3 | 13.7 | 2.4 | 100 |
| Peru | 61.5 | 30.1 | 7.5 | 0.8 | 100 | 51.3 | 37.5 | 9.2 | 2.0 | 100 | 31.5 | 39.8 | 21.4 | 7.3 | 100 |
| Philippines | 64.4 | 28.5 | 6.3 | 0.9 | 100 | 56.1 | 35.2 | 7.6 | 1.1 | 100 | 33.8 | 42.2 | 19.0 | 5.1 | 100 |
| Korea | 60.7 | 31.6 | 6.6 | 1.0 | 100 | 33.2 | 48.2 | 15.7 | 3.0 | 100 | 18.5 | 31.7 | 29.8 | 20.0 | 100 |
| Russia | 46.2 | 40.2 | 11.5 | 2.2 | 100 | 32.1 | 45.1 | 17.6 | 5.2 | 100 | 25.1 | 36.2 | 28.6 | 10.1 | 100 |
| Singapore | 60.6 | 33.2 | 5.6 | 0.6 | 100 | 32.3 | 49.4 | 15.3 | 3.1 | 100 | 20.4 | 31.4 | 27.2 | 20.9 | 100 |
| Thailand | 61.9 | 30.5 | 6.7 | 0.9 | 100 | 37.7 | 46.2 | 13.3 | 2.7 | 100 | 27.0 | 36.7 | 24.6 | 11.7 | 100 |
| USA | 44.4 | 37.6 | 14.8 | 3.1 | 100 | 35.1 | 42.5 | 16.3 | 6.0 | 100 | 29.2 | 37.9 | 21.4 | 11.4 | 100 |
| Viet Nam | 54.1 | 34.6 | 10.2 | 1.1 | 100 | 50.2 | 39.7 | 8.0 | 2.1 | 100 | 29.0 | 37.8 | 24.6 | 8.5 | 100 |
| Developed economies | 48.1 | 36.9 | 12.5 | 2.4 | 100 | 32.3 | 43.2 | 18.4 | 6.1 | 100 | 26.1 | 35.7 | 23.5 | 14.7 | 100 |
| Developing economies | 55.5 | 34.2 | 9.1 | 1.2 | 100 | 41.6 | 43.9 | 12.0 | 2.5 | 100 | 28.0 | 37.5 | 24.0 | 10.5 | 100 |
| All APEC | 53.6 | 34.9 | 9.9 | 1.5 | 100 | 39.7 | 43.8 | 13.3 | 3.3 | 100 | 27.6 | 37.1 | 23.9 | 11.4 | 100 |

Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

Table A7. Change in population in APEC economies, 1960-2005 and 2005-2050

| | 1960-2005 | | | | | 2005-2050 | | | | |
|-------------------------|-------------------------------|----------------------|------------------------------------|-------------------------|----------------|-------------------------------|----------------------|------------------------------------|-------------------------|----------------|
| | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (over 75) | Grand total | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (over 75) | Grand total |
| | (total percentage change - %) | | | | | (total percentage change - %) | | | | |
| Australia | 49.4 | 115.8 | 148.6 | 360.4 | 97.7 | 14.7 | 16.4 | 74.1 | 209.7 | 38.1 |
| Brunei | 268.8 | 522.2 | 316.7 | 200.0 | 354.9 | 20.9 | 72.6 | 436.0 | 1300.0 | 82.3 |
| Canada | 16.5 | 116.4 | 170.7 | 319.4 | 80.2 | 12.2 | 4.4 | 75.7 | 212.9 | 32.5 |
| Chile | 57.4 | 176.3 | 188.8 | 410.5 | 113.1 | -15.4 | 9.8 | 137.1 | 358.8 | 26.8 |
| China | 38.7 | 169.0 | 172.8 | 336.9 | 99.7 | -26.5 | -16.6 | 109.8 | 420.8 | 7.3 |
| Hong Kong | 22.4 | 193.0 | 416.7 | 1889.5 | 129.6 | -10.9 | -14.5 | 116.3 | 361.6 | 27.2 |
| Indonesia | 88.0 | 194.8 | 240.7 | 309.1 | 135.7 | -17.3 | 24.6 | 207.2 | 547.8 | 31.3 |
| Japan | -31.0 | 45.0 | 214.6 | 590.0 | 35.9 | -37.3 | -39.6 | -16.5 | 110.2 | -19.8 |
| Malaysia | 153.8 | 319.7 | 332.6 | 228.8 | 215.2 | -6.1 | 59.4 | 281.5 | 717.8 | 54.5 |
| Mexico | 112.5 | 278.9 | 271.5 | 520.2 | 175.3 | -26.8 | 21.3 | 220.2 | 481.3 | 26.9 |
| NZ | 31.5 | 98.8 | 115.9 | 198.7 | 72.7 | -2.2 | 8.8 | 74.4 | 208.6 | 27.1 |
| PNG | 183.8 | 211.2 | 182.5 | 112.5 | 191.9 | 24.0 | 135.0 | 352.2 | 702.9 | 83.7 |
| Peru | 128.8 | 241.5 | 236.9 | 588.8 | 174.6 | -11.9 | 51.8 | 233.0 | 415.6 | 43.2 |
| Philippines | 172.3 | 286.7 | 279.9 | 289.1 | 212.6 | 0.0 | 99.1 | 315.3 | 664.6 | 66.1 |
| Korea | 4.5 | 191.5 | 351.8 | 482.6 | 91.4 | -50.8 | -41.7 | 68.5 | 487.4 | -11.6 |
| Russia | -16.4 | 34.8 | 84.2 | 180.5 | 20.1 | -41.5 | -39.9 | 21.7 | 46.8 | -25.1 |
| Singapore | 41.1 | 294.1 | 619.6 | 1230.0 | 164.9 | -26.6 | -26.0 | 106.6 | 690.2 | 16.1 |
| Thailand | 38.8 | 245.7 | 352.4 | 579.4 | 127.8 | -23.4 | -15.0 | 97.0 | 358.3 | 6.9 |
| USA | 27.2 | 82.1 | 78.0 | 209.2 | 61.1 | 11.9 | 19.5 | 75.9 | 154.5 | 34.2 |
| Viet Nam | 134.5 | 189.8 | 97.8 | 392.0 | 152.7 | -18.4 | 34.4 | 335.5 | 473.6 | 41.1 |
| Developed economies | 8.2 | 88.8 | 137.2 | 306.3 | 61.3 | -7.2 | -5.2 | 47.0 | 174.9 | 14.8 |
| Developing economies | 55.6 | 166.7 | 174.6 | 318.0 | 107.6 | -21.8 | -0.7 | 133.7 | 390.5 | 16.4 |
| All APEC | 44.8 | 145.7 | 162.7 | 313.3 | 95.8 | -19.3 | -1.6 | 108.7 | 305.3 | 16.1 |

Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).

Table A8. Change in share of population in APEC economies, 1960-2005 and 2005-2050

| | 1960-2005 | | | | 2005-2050 | | | |
|-------------------------|----------------------------|----------------------|------------------------------------|-------------------------|----------------------------|----------------------|------------------------------------|-------------------------|
| | Young people (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (Over 75) | Young People (below 25) | Prime age (25-54) | Potential older workers (55-74) | Old people (over 75) |
| Australia | -10.8 | 3.6 | 3.6 | 3.6 | -5.6 | -6.7 | 4.6 | 7.8 |
| Brunei | -11.1 | 12.1 | -0.6 | -0.4 | -16.0 | -2.4 | 13.0 | 5.4 |
| Canada | -17.0 | 7.5 | 6.0 | 3.5 | -4.8 | -9.5 | 5.8 | 8.4 |
| Chile | -14.8 | 9.6 | 3.3 | 1.9 | -14.0 | -5.7 | 11.0 | 8.6 |
| China | -16.8 | 11.9 | 3.4 | 1.4 | -12.0 | -10.3 | 12.3 | 10.0 |
| Hong Kong | -24.5 | 11.0 | 8.7 | 4.7 | -8.4 | -16.7 | 11.0 | 14.1 |
| Indonesia | -12.0 | 8.2 | 3.1 | 0.7 | -17.5 | -2.1 | 13.4 | 6.2 |
| Japan | -24.2 | 2.5 | 14.5 | 7.1 | -5.4 | -10.0 | 1.1 | 14.4 |
| Malaysia | -12.2 | 9.8 | 2.4 | 0.1 | -19.8 | 1.3 | 12.8 | 5.7 |
| Mexico | -14.5 | 10.8 | 2.4 | 1.3 | -20.7 | -1.7 | 14.2 | 8.2 |
| NZ | -11.2 | 5.5 | 3.3 | 2.4 | -8.3 | -6.0 | 6.2 | 8.1 |
| PNG | -1.7 | 2.1 | -0.2 | -0.2 | -19.5 | 9.5 | 8.2 | 1.9 |
| Peru | -10.3 | 7.3 | 1.7 | 1.2 | -19.7 | 2.3 | 12.2 | 5.3 |
| Philippines | -8.3 | 6.7 | 1.3 | 0.2 | -22.3 | 7.0 | 11.4 | 4.0 |
| Korea | -27.6 | 16.5 | 9.0 | 2.0 | -14.7 | -16.4 | 14.2 | 17.0 |
| Russia | -14.0 | 4.9 | 6.1 | 3.0 | -7.1 | -8.9 | 11.0 | 5.0 |
| Singapore | -28.3 | 16.2 | 9.7 | 2.5 | -11.9 | -17.9 | 11.9 | 17.8 |
| Thailand | -24.2 | 15.8 | 6.6 | 1.8 | -10.7 | -9.5 | 11.2 | 9.0 |
| USA | -9.3 | 4.9 | 1.6 | 2.9 | -5.8 | -4.6 | 5.1 | 5.4 |
| Viet Nam | -3.9 | 5.1 | -2.2 | 1.0 | -21.2 | -1.9 | 16.6 | 6.4 |
| Developed economies | -15.9 | 6.3 | 5.9 | 3.7 | -6.2 | -7.5 | 5.2 | 8.6 |
| Developing economies | -13.9 | 9.7 | 2.9 | 1.3 | -13.6 | -6.4 | 12.1 | 8.0 |
| All APEC | -14.0 | 8.9 | 3.4 | 1.7 | -12.1 | -6.7 | 10.6 | 8.1 |

Source: UN World Population Prospects: The 2006 Revision Population Database (<http://esa.un.org/unpp/>).