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Ageing and health expenses in New South Wales – revisiting the long-term modelling approach

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[1] The views in this paper are those of the authors and do not necessarily reflect those of NSW Treasury. This publication can be accessed from NSW Treasury's website www.treasury.nsw.gov.au

NSW GOVERNMENT

Preface

The 2016 NSW Intergenerational Report (IGR) projected health expenses to be the largest driver of long-run expense growth for NSW. It projected health expenses to grow from 28 per cent of total expenses by 2056 to 36 per cent — at a long-term annual growth rate of 6.0 per cent — in the absence of policy intervention. This reflects the pressures of an ageing population, and non-demographic factors such as advancements in health technology and expectations for more and improved health services over the next 40 years.

Health is a key component of individual and social wellbeing and enabler of economic growth. Healthier people are more likely to live longer, productively participate in the economy, and actively contribute to the community. While Australians enjoy a high life expectancy, we are faced with the challenge of a rising burden of chronic disease. Chronic diseases can become more serious over time and increase a person's demand for health services later in life. Reorienting the health system to effectively and efficiently target prevention and early intervention can improve health outcomes, alleviate the fiscal impact of population ageing and lift economic participation and productivity.

NSW Treasury publishes long-run health expense projections every five years, with the next projections to be published with the 2021 IGR. Projections are calculated using NSW Treasury's Long-Term Fiscal Pressures Model (LTFPM), based on anticipated growth in service delivery cost and demand volumes. This paper reviews the approach to health expense projections in the LTFPM and proposes a refinement to better reflect recent trends in the proportion of years spent in good and poor health as people age. The proposed methodology and projections contained in this paper are preliminary and will be finalised in the 2021 IGR to be released in early 2021.

Acknowledgement

NSW Treasury acknowledges the Traditional Owners of the land on which we live and work, the oldest continuing cultures in human history.

We pay respect to Elders past and present, and the emerging leaders of tomorrow.

We celebrate the continuing connection of Aboriginal and Torres Strait Islander peoples to Country, language and culture and acknowledge the important contributions Aboriginal and Torres Strait Islander peoples make to our communities and economies.

We reflect on the continuing impact of policies of the past and recognise our responsibility to work with and for Aboriginal and Torres Strait Islander peoples, families and communities, towards better economic, social and cultural outcomes.

Note The authors thank Luke Maguire and Aruna Sathanapally for overseeing and championing this paper, and Michael Gadiel for his technical advice. Authors are deeply appreciative of NSW Health for providing data, and to the external stakeholders who generously provided their expertise and insights.

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Abstract

Health expenses represent the largest driver of projected long run expense growth. The 2016 IGR health expense projections rest on an assumption that the share of health expenses by age remains constant over time. This means that with an ageing population, a higher number of people in older age cohorts in the future will result in a proportionately more costly health system. Under this assumption, the 2016 IGR estimated population ageing to contribute to roughly 10 per cent of the projected long-term annual health expense growth.

The paper reviews the 2016 IGR assumption that the share of health expenses by age remains constant over time, by examining data recently released by the Australian Institute of Health and Welfare (AIHW) and comparing trends to existing theories on the relationship between morbidity and life expectancy. The paper concludes that Australia's recent morbidity trend is most aligned with that of a 'dynamic equilibrium', where increases in life expectancy have been accompanied by proportionate increases in years of life spent in good health. Accordingly, the paper proposes two revisions to the LTFPM. First, to reflect a delayed onset of ill-health as life expectancy increases; and second, to divide the 85+ age cohort into five-year cohorts to age 100 to more accurately model this impact. These revisions reduce the projected long-term annual health expense growth rate by approximately 0.06 percentage points, equivalent to a reduction of 0.12 per cent of Gross State Product (GSP) in the estimated fiscal gap.

The paper models two alternative morbidity scenarios on health expenses — 'compression of morbidity' and 'expansion of morbidity'. An 'expansion of morbidity' scenario results in an increase to the projected fiscal gap by 0.36 percentage points relative to the 'dynamic equilibrium' baseline scenario; while a 'compression of morbidity' scenario results in a reduction by 0.24 percentage points. It should be emphasised that these results do not capture any second-round impacts of the health of older Australians on key economic drivers of participation and productivity, and therefore likely underestimates the broader benefits of Australians living for longer in good health. These findings suggest that measures to support Australians to age in good health can, in addition to the benefits to people themselves, serve to alleviate the State's fiscal gap.

JEL Classification Numbers: H51, I18

Keywords: public health spending, long-term projections

1. Introduction

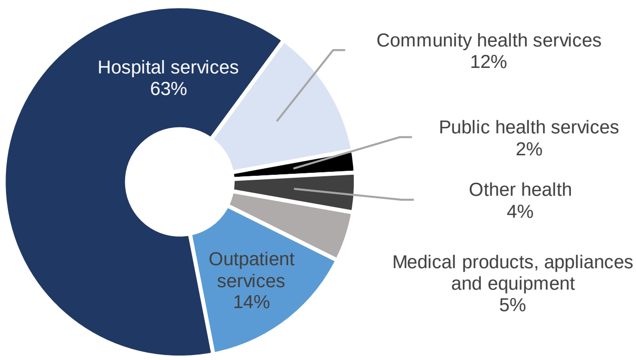
Health expenses borne by state and territory governments, such as New South Wales, primarily relate to the costs of delivering public hospital (inpatient and outpatient) and community health services.

NSW health expenses have grown steadily over time, from around 24 per cent of total expenses in 1998-99, to 28 per cent today. The 2016 NSW IGR projected that in the absence of policy intervention, this will continue to grow to 36 per cent by 2056.

NSW health expenses in 2018-19 totalled $23.0 billion, of which hospital services represented almost two-thirds (63 per cent) of the total (Chart 1).[2] The next largest categories were outpatient services (14 per cent), which include paramedical services and public dental care, and community health services (12 per cent). The remaining roughly 10 per cent incorporate public health spending and costs of medical products, appliances and equipment.

Health capital expenditure and revenues are separately accounted for and projected in the LTFPM. This includes Australian Government funding contributions to public hospital services under the National Health Reform Agreement and payments from private health insurers.

Chart 1 *NSW health expenses, 2018-19*



Source: Australian Bureau of Statistics (ABS) cat no. 5512.0, released 28 April 2020

A person's cost to the health system reflects several factors including: their health status (and therefore their need for healthcare), their usage of the system, and, the cost of delivering the healthcare being accessed.

The NSW LTFPM projects economic, revenue and expense growth over a 40-year period on a 'no policy change' basis. To project NSW health expense growth, the LTFPM combines demographic projections by age and gender, with projections of key drivers of future growth in demand for, and cost of, providing health services. These demographic projections reflect assumptions around fertility, mortality, life expectancy, and migration — and project an ageing population for New South Wales.

[2] Australia Bureau of Statistics (2020), *Government Finance Statistics, Annual, 2018-19 financial year*, viewed 15 December 2020, https://www.abs.gov.au/statistics/economy/government/government-finance-statistics-annual/2018-19

The 2016 IGR estimated that population ageing contributes 2.2 percentage points to the State's projected fiscal gap[3] by 2056 and that this is primarily channelled through health expenses. The impact of population ageing on long-run health expenses was modelled by assigning a relative cost to each age-gender cohort. The assigned relative costs of each cohort were held constant over time and applied to the demographic projections. For example, the average cost of a 70-year-old to the NSW health system, relative to a 15-year-old, was assumed to be constant over the 40-year projected period. This assumption can be interpreted to suggest that increasing life expectancy will result in more people in ill-health. As such, a larger fraction of the population will have a higher need for health services over time, putting upward pressure on the health system.

In recent years, other jurisdictions that held a similar assumption to the 2016 IGR have revised their methodologies to reflect a trend towards an improved health status of older people over time as life expectancies increase.[4] The Australian Burden of Disease Study: impact and causes of illness and death in Australia 2015 (*Australian Burden of Disease 2015*) recently released by AIHW provides updated estimates of measures of population health, including estimates of life expectancy and adjustments to life expectancy adjusted by time spent living with disease and injury.[5] This has presented a timely opportunity to review Australia's morbidity trend and determine whether the 2021 NSW IGR should reflect a similar methodological revision. The models used in this paper are based on actuals data to 2018-19, and therefore do not capture the impacts of the COVID-19 pandemic. The way in which the pandemic impacts future health expenses will be reviewed as part of the 2021 IGR.

2. Morbidity and life expectancy

Three main theories have been proposed for the relationship between life expectancy and morbidity in developed countries:

- The **'compression of morbidity'** theory states that a person's lifetime burden of illness could be reduced if the onset of chronic disease is delayed, as long as this delay is greater than the increase in life expectancy. Medical advancements, changes in lifestyle, and increasing focus on preventive health policies can help delay the onset of disease. Under this theory, increasing life expectancy is associated with more years spent in good health.[6]
- An opposing hypothesis is the **'expansion of morbidity'** theory. This theory proposes that health policy has been focussed on extending the life of those with disease and disability, thereby prolonging years of ill health due to chronic diseases and other age-related illnesses. Under this theory, increasing life expectancy is associated with more years spent in ill-health.[7]

3 The fiscal gap is the projected change in revenues less expenditures over a 40-year projection period, expressed as a percentage of GSP.

4 Refer to Section 2 of the paper.

5 AIHW (2019), *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2015,* AIHW, Canberra.

6 Fries, JF (2003), Measuring and monitoring success in compressing morbidity, *Annals of Internal Medicine*, *13*(5) Pt 2, 455-459.

7 Graham, P, Blakely T, Davis P, et al (2004), Compression, expansion, or dynamic equilibrium? The evolution of health expectancy in New Zealand, *Journal of Epidemiology & Community Health, 58*, 659-666.

- A hypothesis that sits between the extremes of compression and expansion of morbidity is the **'dynamic equilibrium'** theory This suggests that years in ill-health will increase as life expectancy increases, but the severity of illness will fall. Overall, the proportion of years in good and in poor health will remain constant as life expectancy increases.[8]

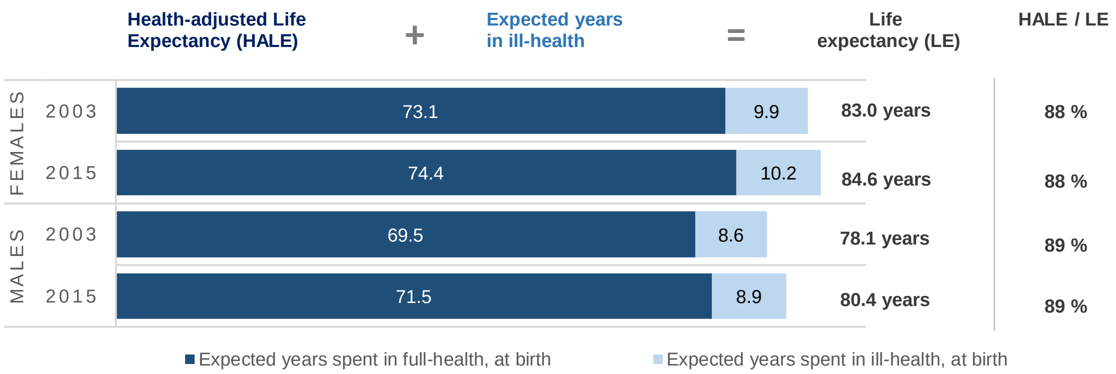
Empirical evidence in Australia

The paper examines changes in Health-adjusted Life Expectancy to life expectancy ratio (HALE/LE ratio) for Australia over time to determine which morbidity scenario is most aligned with Australia's experience. The HALE/LE ratio is the number of years a person can be expected to live in full health, expressed as a proportion of their life expectancy. The HALE/LE ratio over time can provide insights into how the relationship between morbidity and life expectancy has changed over time. The paper compares the HALE/LE ratio both at birth and at age 65 for the years 2003 and 2015.

The HALE/LE ratio is calculated using Health-adjusted Life Expectancy (HALE) and life expectancy (LE) data published in the *Australian Burden of Disease Study 2015*. HALE represents equivalent years spent living in full health without disease and injury, for a given life expectancy. It considers the number of people affected by diseases, the duration of impact, and the severity of that disease. HALE and life expectancy can be calculated at any age but is typically reported on at birth (describing health in a future generation born from that year) and at age 65 (describing health in the older population).

According to the *Australian Burden of Disease Study 2015*, a female born in 2003 could expect to live 73.1 years in full health, from a life of 83.0 years; while a male born in 2003 could expect to live 69.5 years in full health from a life of 78.1 years. Over the twelve years to 2015, female life expectancy at birth increased by 1.6 years to 84.6 years, while HALE increased by 1.3 years to 74.4 years. Male life expectancy at birth increased by 2.3 years to 80.4 years; while HALE increased by 2.0 years to 71.5 years. For both females and males, the HALE/LE ratio remained broadly constant at 88 per cent for females and 89 per cent for males — therefore the increases in HALE is keeping pace with increases in life expectancy over this period (Chart 2).

Chart 2 *Life expectancy and HALE at birth in Australia in 2003 and 2015*

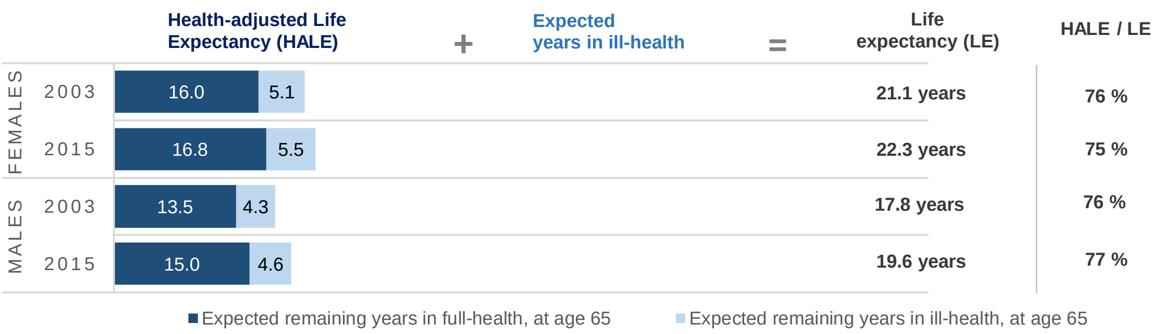


Source: AIHW 2019, NSW Treasury

[8] Graham, P, Blakely T, Davis P, et al (2004), Compression, expansion, or dynamic equilibrium? The evolution of health expectancy in New Zealand, *Journal of Epidemiology & Community Health, 58*, 659-666.

A female at age 65 in 2003 could expect to live an additional 16.0 years in good health of a remaining 21.1 years of life. This increased by 2015 to an additional 16.8 healthy years of 22.3 years of life. A male aged 65 in 2003 could expect to live 13.5 healthy years of a remaining 17.8 years of life. By 2015, this increased to 15.0 healthy years of 19.6 years of life. For both females and males, this is equivalent to around three-quarters of remaining life years to be spent in good health (Chart 3).

Chart 3 *Life expectancy and HALE at age 65 in Australia between 2003 and 2015*



Source: AIHW 2019, NSW Treasury

These estimates therefore suggest that Australians are living longer, and that this is accompanied with broadly proportionate increases in both healthy and unhealthy years. This provides support for a revision to the LTFPM to reflect a future morbidity assumption in line with a ‘dynamic equilibrium’.

Recent international approaches to incorporate morbidity trends

New Zealand Treasury, UK Office for Budget Responsibility, the Organisation of Economic Co-operation and Development (OECD) and the European Commission have in recent years released long-term health expenses projections that assess the notion of ‘healthier ageing’, where the onset of ill-health shifts with lengthening life expectancy. It should be noted that the interpretation of, and approach to modelling, morbidity scenarios such as ‘compression of morbidity’ and ‘expansion of morbidity’ vary between publications. These varying approaches are discussed below.

New Zealand Treasury

Since their 2013 Statement on New Zealand’s Long-Term Fiscal Position, the New Zealand Treasury’s projections of future health expenses have allowed for some degree of ‘healthy ageing’. Increases in longevity are reflected in the weighting of health funding continually moving to older age groups over time.[9] The term “healthy ageing” captures the improvement in older people’s health status over recent decades, as a result of advances in medical treatments, dietary changes, reduced levels of smoking and other factors. Accordingly, New Zealand Treasury has stated that “A 70-year

[9] New Zealand Treasury (2016), Demographic, Economic and Fiscal Assumptions and Modelling Methods in the 2016 Long-Term Fiscal Model: Background Paper for He Tirohanga Mokopuna: 2016 Statement on the Long-Term Fiscal Position, Wellington.

old now is not like a 70-year-old in the 1960s, and it is reasonable to expect such improvements in health status to continue in future."[10]

For their 2013 Statement, health cost weightings were adjusted by age cohort in line with a 'dynamic equilibrium' scenario — where part of every additional year of life expectancy is assumed to be in good health. This was modelled by using a 0.75 rate of shifting of health cost weightings for every year of additional year of life expectancy, applied to most health cost categories. This compares to the previous assumption where current-year health cost weightings were applied to future years with no adjustment. This is similar to the 2016 NSW IGR assumption.

The new 'dynamic equilibrium' assumption was found to reduce projected health expenditure as a percentage of GDP by 2060 to 10.8 per cent, compared to 12.6 per cent under the previous assumption of 'expansion of morbidity' (no assumption of healthy ageing scenario). A full 'compression of morbidity' scenario (or 'full healthy ageing' scenario) would reduce projected health expenditure further to 9.9 per cent of GDP.[11]

The 2016 Statement simplified the methodology, retaining an assumption of 'healthy ageing'.[12]

Office for Budget Responsibility (OBR), UK

The OBR's 2017 *Fiscal Sustainability Report* incorporated a change in morbidity assumption in its long-term health expense projections.[13] While previous Fiscal Sustainability Reports assumed health status by age cohort and gender remain constant as the population aged (described by the OBR as an implicit assumption of an expansion of morbidity); the modelling was revised to assume that increases in life expectancy are split between extra time spent in good health and in ill health. This change in assumption reduced health spending by around 0.7 per cent of GDP.

Relative to the central scenario, which represented some expansion of morbidity; a slower 'expansion of morbidity' was found to reduce health spending projections in 2065-66 by -0.6 per cent of GDP. This compares to a reduction by 0.9 per cent of GDP under 'compression of morbidity'. [14]

Organisation of Economic Co-operation and Development (OECD)

The OECD in 2013 published a new set of public health and long-term care expenditure projections to 2060.[15] For Australia, it projected the public health care spending to GDP ratio to increase by 2.5 percentage points, assuming that some policy action is taken to control expense growth. The

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[10] New Zealand Treasury (2013), Fiscal Sustainability Under an Ageing Population Structure: Background Paper for the 2013 Statement on the Long-Term Fiscal Position, Wellington, 22.

[11] New Zealand Treasury (2013), Health Projections and Policy Options: Background Paper for the 2013 Statement on the Long-Term Fiscal Position, Wellington.

[12] New Zealand Treasury, Demographic, Economic and Fiscal Assumptions and Modelling Methods in the 2016 Long-Term Fiscal Model: Background Paper for He Tirohanga Mokopuna: 2016 Statement on the Long-Term Fiscal Position.

[13] Office for Budget Responsibility (2017), Fiscal Sustainability Report, Office for Budget Responsibility, London.

[14] Lichetta, M and Stelmach, M (2016), Fiscal sustainability analytical paper: Fiscal sustainability and public spending on health, Office for Budget Responsibility, London.

[15] De La Maisonneuve, C. and J. Oliveira Martins (2013), Public Spending on Health and Long-term Care: A new set of projections, OECD Economic Policy Papers No. 6, OECD, Paris.

projection accounts for 'healthy ageing', whereby all additional years of life are translated into years of good health, by shifting rightwards the expenditure curve by age cohort. This effectively postpones age-related increases in expenditure.

The OECD conducted sensitivity analysis for both 'compression of morbidity' and 'expansion of morbidity' scenarios. 'The compression of morbidity' scenario assumed longevity gains were doubled into additional years in good health. The 'expansion of morbidity' scenario assumed longevity gains were not translated into years of good health. For Australia, it found that a 'compression of morbidity' assumption detracts from projection by 0.6 percentage points of GDP by 2060 (alleviating cost pressures); while an 'expansion of morbidity' adds 0.6 percentage points.

European Commission

The European Commission projected combined long-term health expenses in its 2018 Ageing Report for the 28 European Union member states[16]. It estimates the impact of an ageing population to increase healthcare spending by 1.1 percentage points of GDP from 2016 to 2070. When applying an assumption of 'healthy ageing' — based on a 'compression of morbidity' hypothesis that assumes all future gains in life expectancy are spent in good health — the increase in healthcare spending over the same period due to ageing is reduced to only 0.2 percentage points of GDP.

3. Revising the approach to health expense projections

This section examines the 2016 IGR approach to long-term health expense projections and proposes revisions for the 2021 IGR to reflect assumptions of a future morbidity trend aligned with that of a 'dynamic equilibrium' scenario. The effect of these revisions on the projected long-term health expense growth is estimated by comparing to a base case. The base case was calculated using the 2016 IGR LTFPM, updated for recent health expenditure data to 2018-19 and revised population projections. It will be termed the '2016 IGR-equivalent Model' in the rest of the paper.

A review of the 2016 IGR projection methodology

The 2016 IGR LTFPM split health expenses into three functional categories in line with ABS classifications at the time — patients in acute care institutions, community health service and other health services. Each expense category was separately projected.

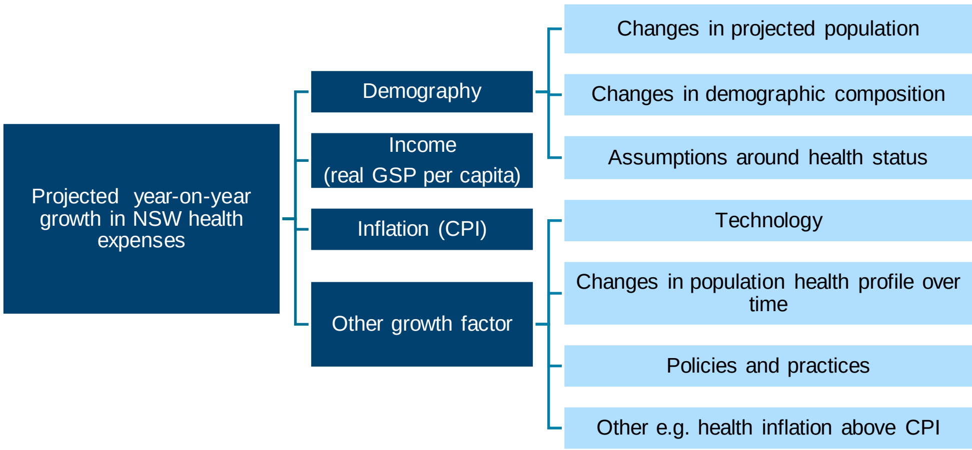
For each of these categories, annual year-on-year growth was projected by modelling the impact of:

- **population growth and changes in demographic composition**, including the effects of an ageing population;
- **income,** represented by real Gross State Product (GSP) per capita in NSW. This term reflects that healthcare is viewed as a luxury good and is driven by an income effect. Community expectations grow as incomes rise and governments tend to respond with higher service levels;

[16] European Commission services Directorate General for Economic and Financial Affairs (2018), *The 2018 Ageing Report: Economic and Budgetary Projections for the EU Member States (2016-2070)*, Institutional Paper 079, European Commission, Brussels.

- **inflation,** represented by the Sydney headline Consumer Price Index (CPI); and
- **other growth factor (OGF)**. This reflects cost pressures not captured through the above drivers, based on historical trends. It includes unidentified policy and other changes embedded within the expenses. For example, the impact of new therapies and technologies, changes in the population health profile, and changes in the delivery of health services over time (Chart 4).

Chart 4 *Drivers of health expense in the IGR model*



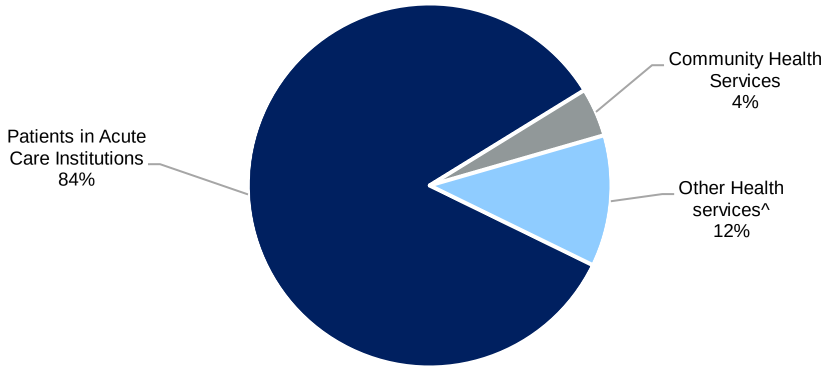
Mathematically, this methodology can be displayed as:

$$\frac{E^i_{t+1}}{E^i_t} = \frac{GSP_{t+1}}{GSP_t} * \frac{POP^i_{t+1}}{POP^i_t} * \frac{CPI_{t+1}}{CPI_t} * \frac{OGFI^i_{t+1}}{OGFI^i_t} * (1 + Policy\ Growth^i_{t+1})$$

where: E^i is government expenditure for expense category 'i'; GSP is real GSP per capita; POP^i is the State estimated resident population weighted by the age-cost indices to account for the demographic change for expense category 'i'; CPI is the capital city consumer price index; $OGFI^i$ is an OGF index for expense category 'i'; and '$PolicyGrowth^i_{t+1}$' is the growth in expenditure in expense category 'i' between years 't' and 't+1' due to changes in government policy.

The 2016 IGR projected long-term health expenses to grow at an average rate of 6.3 per cent a year over the first decade and 6.0 per cent in the long term, predominantly representing the cost of providing acute care in the hospital system (Chart 5). As noted in the 2016 IGR, the primary drivers of future health expense growth, excluding inflation, are non-demographic trends such as rising income, technological advancements and changing healthcare demands and delivery. Population ageing, when controlled for total population size increases, was found to have contributed around 10 per cent of the long-term projected health expense growth rate.

Chart 5 *Contribution to long-term total health expense growth by service type**



*2016 IGR fiscal expenses are categorised under the ABS General Purpose Classification system, for detail see Box 1
^Other Health Services are assumed to be not age sensitive, and therefore age-cost indices are not applied
Source: NSW Treasury 2016 IGR

Age-cost indices

In the NSW LTFPM, the impact of the changing demographic composition on health expenses are modelled through 'age-cost indices', which applies a relative cost weighting to each age cohort. Said differently, the NSW LTFPM divides the population into age cohorts, and assigns each cohort a weighting that reflect the cohort's usage of and cost to the health system.[17]

Age cost-indices are calculated for expense areas that are demand-driven and considered to be influenced by demographic composition. Of the three health expense categories in the 2016 IGR, Patients in Acute Care Institutions and Community Health Services were considered to be influenced by demographic composition and therefore age-cost indices were applied.

Age-cost indices are calculated using Ministry of Health data on average costs to the health system by gender split into five-year age cohorts up to age 85, after which, an 85+ age group captures the average usage and cost of the remaining ages. This is then normalised so that the total population usage index equals 100. The age-cost indices used in the 2016 NSW IGR for health expenses are presented in Appendix A.

Estimation of the annual increase in expenses due to demographic compositional change is calculated by weighting the population (by five-year cohorts) by these indices to produce a weighted average of the population. The growth rate of this weighted average of the population is equivalent to the growth rate of expenses due to all demographic factors, i.e. both composition and population growth. The compositional effect is isolated by dividing the growth rate of the weighted population by the growth rate of the (unweighted) total population.

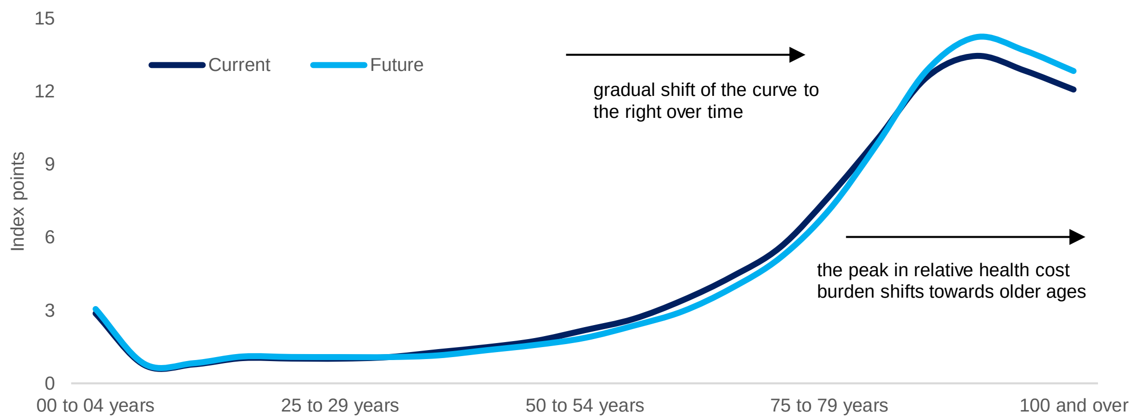
[17] In reality, 'proximity to death' is a stronger driver of heath spending at older ages, however age provides a useful proxy and a simpler methodology.

In the 2016 IGR, these age-cost indices were held constant for the projected 40-year period. This assumption means that different age cohorts' reliance on the health system (both frequency of use and relative cost) were projected to remain constant over time. As the proportion of people in older cohorts increases, so too does the proportion of people consuming higher amounts of health spending — thereby adding to the pressures of an ageing population on health expenses. This methodology therefore is misaligned with the recent evidence in Australia that suggests that increasing life expectancy has been accompanied by some years of good health, keeping the overall proportion of years in good and ill-health broadly constant.

Proposed revisions to the approach

This paper proposes two revisions to the health expense projection methodology to align with a 'dynamic equilibrium' morbidity scenario. The first revision is an adoption of 'dynamic' age cost indices — where the age-cost index curve that represents relative health expenses across age cohorts gradually shift towards the right (towards older age groups) over time to reflect dynamic equilibrium increases in healthy years in line with longevity gains (Chart 6) — rather than static age-cost indices held constant over the projection period. This change in methodology pushes the peak health cost burden further towards the very later years of life. The second revision further refines the 85+ age cohort grouping by extending the calculation of age-cost indices for five-yearly age cohorts to age 100. This better captures the impacts of adopting a dynamic age-cost index approach (Box 1).

Chart 6 *Stylised illustration of dynamic age-cost indices*



Note. This chart presents a stylised set of age-cost indices, which are normalised so that the total population index equals 100. The curve is gradually shifted towards the right over time to reflect an assumption that the onset of ill-health is delayed over time, which lowers the relative heath cost during the early stage of ageing (roughly from mid 30s to early 80s). This pushes out the peak in relative health cost burden towards later in life (from late 80s), and a higher peak as a result of relative health costs being shifted towards the later years.

The impacts of these revisions to the methodology on the projected long-term annual health expense growth rate and the NSW fiscal gap are tested with reference to a comparison model. This comparison model updates the 2016 IGR LTFPM for actual data to 2018-19 from the ABS and the NSW Ministry of Health, as well as updated population projections. The comparison model approach is used — rather than applying dynamic age-cost indices to the 2016 IGR LTFPM — because data was not available to break down the 2016 IGR age-cost indices by five-year age-cohorts between the ages 85 to 99. Therefore, three comparison models (Table 1) have been used to assess the impact of the revisions to the methodology.

Table 1: Models to assess the impact of the proposed revisions to the methodology

Model	Age cohort breakdown	Age cost indices
2016 IGR-equivalent model (consistent with 2016 IGR methodology)	Single 85+ cohort	Static
Static Age-Cost Indices Model	5-year cohorts up to 100+	Static
Baseline – 'Dynamic Equilibrium' Model (proposed revised methodology)	5-year cohorts up to 100+	Dynamic

2016 IGR-equivalent model

The 2016 IGR-equivalent model enables the impact of the revised projections to be assessed holding all other assumptions constant. The model is equivalent to the LTFPM used for the 2016 IGR, revised for ABS and NSW Ministry of Health updates to 2018-19 and current population projections as outlined below.

- In 2015, the ABS updated its framework under which Government Finance Statistics data are reported.[18] Following the change in methodology, the expenditure by purpose datasets will be classified under the COFOG-A (Classification of the Functions of Government – Australia), replacing the General Purpose Classification (GPC). The LTFPM is revised to adopt the new classifications to split expenditure into four categories: hospital services (including mental health services), outpatient services, community health services, and the remainder classified as other.
- Revised age cost indices were calculated using the latest available health expense data provided by NSW Ministry of Health (from 2014-15 to 2018-19).
- Updated population forecasts based on the latest NSW Treasury demographic assumptions.

Projections for other inputs into the health expense projection (e.g. inflation, real GSP growth, OGF) in the LTFPM have not yet been finalised, and therefore not reflected in the updates.

Static age-cost indices model

The Static age-cost indices model builds on the 2016 IGR-equivalent model, with an extension of age-cost indices by five-year age cohorts to age 100. It is used to compare the Baseline – 'Dynamic Equilibrium' model with a model where age-cost indices are held constant but incorporate an extension of five-year age cohorts to age 100 for consistency.

Baseline – 'Dynamic Equilibrium' model

The Dynamic Equilibrium model represents the proposed methodology. This builds on the 2016 IGR-equivalent model, and revised for the application of dynamic age-cost indices and with an extension of five-year age cohorts in the calculation of age-cost indices to 100.

[18] ABS (2015), *Australian System of Government Finance Statistics: Concepts, Sources and Methods*, ABS, viewed September 2020, https://www.abs.gov.au/ausstats/abs@.nsf/mf/5514.0

Box 1: Rationale for extending five-yearly age cohorts

The approach of adopting dynamic age-cost indices were first applied to the 2016 IGR LTFPM, holding all things else constant, to assess whether this lowers the long-term annual health expense growth. This result was expected as the use of dynamic age-cost indices effectively delays the heavier use of the health system in older cohorts to later ages (where there are fewer people in the age cohorts) over time, and therefore should reduce the impact of population ageing on health expenses.

Contrary to expectations, projected future health costs were marginally higher compared to that projected in the 2016 IGR — an increase of 0.01 percentage points to the long-term annual health expense growth rate, resulting in an increase of 0.01 per cent of GSP in the fiscal gap.

Examination of the results indicated that the impact of applying dynamic age-cost indices may have been limited by the use of five-yearly age cohorts ending at age 85, where a single average age-cost index was applied to the 85+ age group for males and females. Dynamic age-cost indices shift the relative health system burden from earlier ages to the 85+ age group. Combined with population forecasts of an increasing proportion of people expected to be 85 and above as a result of increasing life expectancy, the impact of relatively lower costs for those aged below 85 as a result of dynamic age-cost indices does not offset the impact of pushing up the relative health costs of the smaller but now costlier 85+ age cohort.

This can be seen when comparing the age-cost index curves where five-yearly age cohorts end at age 85, to those that end at age 100. When using five-yearly age cohorts ending at age 85, the age-cost index curve peaks at the 85+ age cohort (refer to 2016 IGR age-cost index curves at Appendix A). When using five-yearly age cohorts ending at age 100[19], the peak expense is associated with those aged in their 90s (refer to Appendix B for revised age-cost index curves used in this paper). This peak may partly reflect that a shift of service usage from the State-managed hospital and health systems to the Australian Government managed aged care systems. For some costs, there is an uptick towards the oldest ages which may reflect some shift into palliative care run by the states and territories.

As morbidity across the 85 to 99 ages is broad ranging, modelling these ages as a single cohort obscures the impact of lower relative costs of 'younger older' cohorts. To address this limitation, the five-year age cohort groupings used for age-cost indices are extended to age 100. As there is inadequate information to break down the age-cost indices used in the 2016 IGR for the 85+ age group into five-year cohorts; a 2016 IGR-equivalent model is developed using contemporary data on usage and costs per usage that is available by five-yearly age cohorts to age 100. The 2016 IGR-equivalent model is used to assess the impact of the revised methodology and represents the baseline scenario where the methodology is aligned with the 2016 IGR and does not reflect the methodological revisions proposed in the paper.

[19] Calculated based on recent data from the NSW Ministry of Health that provides more detailed five-yearly age cohort breakdowns up to age 100.

Methodology for applying dynamic age-cost indices

Age cost indices are calculated for the base year 2018-19 for the three categories in health expenses expected to be impacted by demographic compositional changes: hospital services, outpatient services and community health services.

To determine shifts in age-cost indices projections over time, age-specific HALEs for the NSW population in 2015 were first estimated using Sullivan's method (Box 2). 2015 was used as reference year, as this was the most recent data point available in the *Australian Burden of Study 2015*. Age-specific life expectancies, both historical and projected, can be calculated using the updated demographic projections from the LTFPM. These two outputs together can be used to calculate age-specific HALE/LE ratios for the NSW population in 2015. A dynamic equilibrium is modelled by holding the 2015 HALE/LE ratios constant going forward; these age-specific HALE/LE ratios can be used to estimate the future increases in HALE years based on projected increases in future life expectancies.

Using the estimated future increases in HALE, the age-cost index curves shift towards older age cohorts over time (see formula below) — so that assumptions on the relative burden to the health system by age cohort is postponed over time, following the healthy ageing of the population. For example, if the expected gain in healthy years life is 5 years, then the relative burden of the 75-79 age cohort on the health system in twenty years would be the same as the current 70-74 age cohort. This transitional effect is applied starting from the age cohort 30-34 for males, where relative health expenses start to increase; and from the 49-50 age cohort for females, following the higher cost child-bearing years.

$$ACI_x^i = ACI_{x-1}^{i-1} * (HALE_x/5) + ACI_x^{i-1} * (1 - HALE_x/5)$$

where i is the year, x is the five-year age cohort from 30-34 for male and 45-49 for female, ending at 100+. The new indices are then re-normalised so that the total population usage index equals 100.

The use of dynamic age-cost indices reflects a revised assumption around future morbidity, where the onset of severe ill-health is delayed, thereby pushing out higher health costs into older age cohorts while earlier age cohorts experience relatively lower costs. This effect interacts with the number of people in each cohort, to produce the net impact on expenses. Appendix B presents the dynamic age cost index shifts for males and females, for the three categories of health expense noted above. These expense categories were chosen because they fit the criteria outlined in the 2016 NSW IGR Technical Note (NSW Treasury, 2016) of being demand-driven, and considered to be influenced by demographic composition.

Box 2: **Estimating HALE using YLD and Sullivan's method**

Years Lived with Disability (YLD) represents the number of years of what could have been healthy life that were instead spent in states of ill health, the non-fatal burden of diseases. Using 2014-16 ABS life table and disease rate data, including estimates to YLD published by the *Australian Burden of Study 2015* (Charts 8 and 9), age-specific HALE for the NSW population in 2015 can be estimated by Sullivan's method:

$$HALE_x = \frac{\sum_x^{100}(1 - YLD_x) * L_x}{l_x}$$

$$0 \leq x \leq 100$$

l_x is number of persons surviving to age x and L_x is the number of years lived within the age interval x to x+1. YLD_x is the crude age-specific YLD rate at age x (per 1,000 people).

Chart 7 *Percentage of remaining life in full health and ill health at each age - NSW **

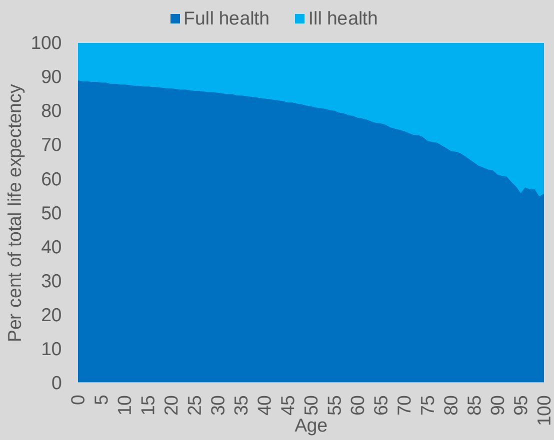
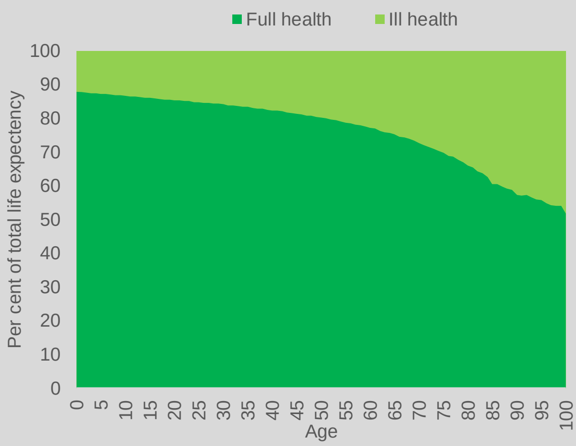


Chart 8 *Percentage of remaining life in full health and ill health at each age – NSW females*



*Estimated using *Australian Burden of Study 2015* data and 2014-16 NSW life tables

Source: ABS, AIHW and NSW Treasury

Sullivan's method was also used in the *Australian Burden of Study 2015* report to calculate HALE estimates.

Findings

Overall impact on long-term health expense growth and the fiscal gap

The impact of the proposed revisions to the methodology are assessed by comparing the three models outlined in Section 3 (Table 1): the 2016 IGR-equivalent model; the Static age-cost indices model and the Baseline – 'Dynamic Equilibrium' model.

Compared to the 2016 IGR-equivalent model, the Baseline – 'Dynamic Equilibrium' Model reduces the long-term annual health expense growth rate by 0.06 percentage points, which translates to a 0.12 per cent reduction in the State's fiscal gap. These results are consistent in direction with the findings by Office for Budget Responsibility and the New Zealand Treasury in their transition from a constant age-expenditure assumption towards incorporation of 'healthier ageing', though the magnitude is smaller.

As discussed in Box 1, the extension of five-yearly age cohorts is necessary to facilitate the application of dynamic age-cost indices. The impact of extending five-yearly age cohorts to age 100 on long term health expense growth is isolated by comparing the results of 2016 IGR-equivalent model and the Static Age-Cost Indices Model. The models are identical, except that the Static Age-Cost Indices Model extends the five-yearly age cohort to age 100. This is to confirm that the reduction in the long-term annual health expense growth from the revised methodology is driven by the use of dynamic age-cost indices rather than the extension of five-yearly age cohorts.

The difference in projected long-term annual health expense growth between the two models is negligible (Table 2).

Table 2: Impact of revisions to projected annual health expense growth and fiscal gap

	Change compared to the 2016 IGR-equivalent model	
Model	Projected long-term annual health expense growth (%)	Fiscal gap[a] (% of GSP)
Static Age-Cost Indices Model (2016 IGR-equivalent model + extension of five-yearly age cohorts to age 100)	-0.0004%	-0.00%[b]
Baseline – 'Dynamic Equilibrium' Model (proposed revised methodology)	-0.0628%	-0.12%

a) A negative result refers to a reduction to, or improvement in, the State's fiscal gap result.

b) Impact is negative but negligible, at one-tenth of a per cent

Detailed analysis of impacts by gender and expense category

The way in which dynamic age-cost indices alleviate the impact of population ageing on health expenses is examined with reference to changes in demographic compositional growth rates — the difference between the growth rates of age-cost weighted population and unweighted population. This difference therefore captures the population ageing impact. The impacts of applying dynamic age-cost indices (Baseline – 'Dynamic Equilibrium' model), compared to using static age-cost indices (2016 IGR-equivalent model) on demographic compositional growth is presented in Table 3.

Table 3: Impact of the Dynamic Equilibrium model on demographic composition growth

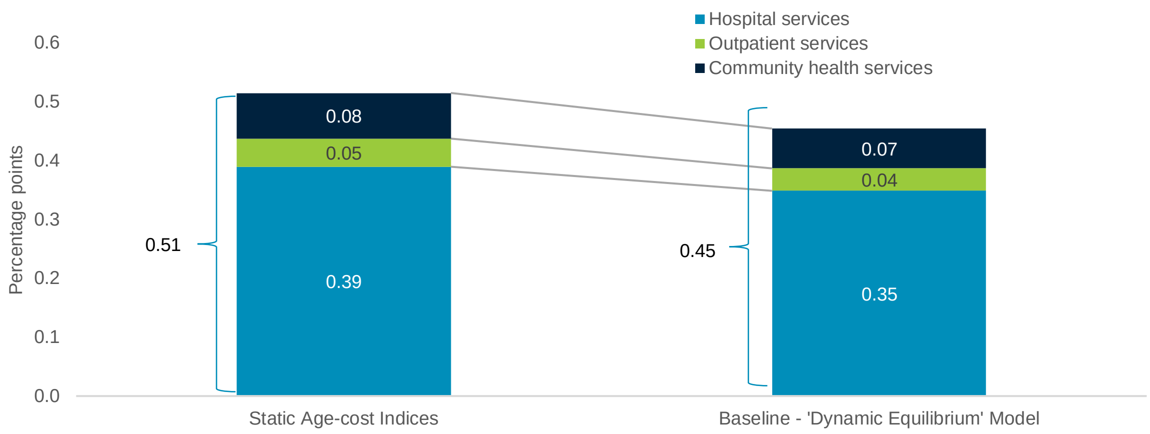
Relative to the 2016 IGR-equivalent Model	**Change in demographic composition growth** (percentage point change – %)	
Expense category	Male	Female
Hospital services	-0.09	-0.04
Outpatient services	-0.10	-0.03
Community health services	-0.12	-0.05

Note: These impacts compare the Baseline – 'Dynamic Equilibrium' model with the 2016 IGR-equivalent model, and reflects the impact of both adoption of dynamic age-cost indices and extension of five-year age cohorts to age 100

Overall, expenses for males drive the majority of reductions in health expenses. This reflects that males have shorter life expectancies than females and have a smaller forecasted population in those most elderly age cohorts than females.

For hospital services, the demographic compositional growth rate is estimated to be 0.09 percentage points lower per year on average for males, and 0.04 percentage points lower for females per year. For outpatient services, a reduction of 0.10 and 0.04 percentage points is projected in the dynamic age-cost indices for males and females respectively. For community health services, a reduction of 0.12 and 0.05 percentage points is projected for males and females respectively.

Chart 9 *Projected demographic compositional growth rate; 2019-20 – 2059-60*



These changes in the demographic compositional growth rate — particularly in hospital services (Chart 9) — drive the estimated 0.06 percentage point reduction in the projected long-term annual health expenses growth rate.

4. Analysis of alternative morbidity scenarios

Many factors can influence the rate of morbidity and its future course is uncertain. This section assesses the potential impact of two alternative morbidity scenarios outlined in Section 2 on future health expenses: an compression of morbidity (where increases in years of life are spent in good health), and an expansion of morbidity (where increases in years of life are spent in ill-health).

Methodology

To model a compression of morbidity scenario, the assumption applied is for the HALE/LE ratio for each age cohort to be 10 per cent higher than the current 2015 HALE/LE ratios throughout the forecast period, i.e. from 2020-21 to 2060-61. Similarly, the expansion of morbidity scenario is modelled by assuming that a HALE/LE ratio to be 10 per cent lower than current 2015 levels throughout the forecast period.

The methodology used to adopt a 'dynamic equilibrium' scenario described in Section 3 cannot be applied for a compression of morbidity scenario. This is because age-cost indices represent the proportions of a certain amount of total health expenditure divided by each age cohort and will always sum to 100 index points. Any reduction in expenditure for a particular age cohort would automatically mean an increase of expenditure by other age cohorts.

An alternative methodology is adopted for the scenario analysis, based on that used in the Productivity Commission's *An Ageing Australia: Preparing for the Future* research paper.[20] An age-specific relative cost index is used to capture population compositional change, which is based on usage data by gender and age cohort provided by the NSW Ministry of Health. Instead of normalising to be a set of indices sum to 100, the average usage per age cohort is then compared to the average usage of total population to get a 'relative cost'. Mathematically, it captures the same relativity of cost per capita between different age cohorts. The change in age-specific relative costs can be viewed as incorporating both a change in relativity between costs by different age cohorts as well as a reduction in the average cost of total population.

Findings

The demographic composition growth under the two alternative scenarios are compared with results of the static age-cost index methodology used in the 2016 IGR and the dynamic age-cost index methodology discussed in the previous section in line with a 'dynamic equilibrium' scenario. The impacts of the scenarios on the demographic compositional growth rate are presented in Charts 11 to 14 and summarised in Table 4 below.

Table 4: Comparison of alternative morbidity scenarios

Change relative to the Baseline – 'Dynamic Equilibrium' model	**Compression of morbidity**		**Expansion of morbidity**	
	percentage point change (%)			
Expense category	Male	Female	Male	Female
Hospital services	-0.17	-0.12	+0.25	+0.20
Outpatient services	-0.19	-0.09	+0.20	+0.10
Community health services	-0.19	-0.13	+0.33	+0.25

As noted in Section 3, the demographic composition growth rates represent the difference between the age-weighted population growth factor and the unweighted population growth factor. This effectively isolates the impact of the change in demographic composition on health expenses.

[20] Productivity Commission (2013), *An Ageing Australia: Preparing for the Future*, Commission Research Paper, Canberra.

Chart 10 *Ageing impact on Hospital services for males*

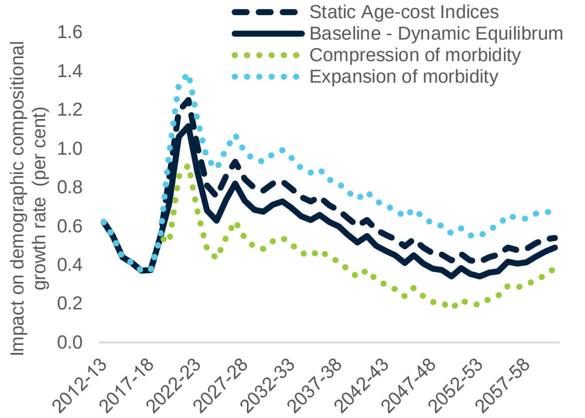


Chart 11 *Ageing impact on Hospital services for females*

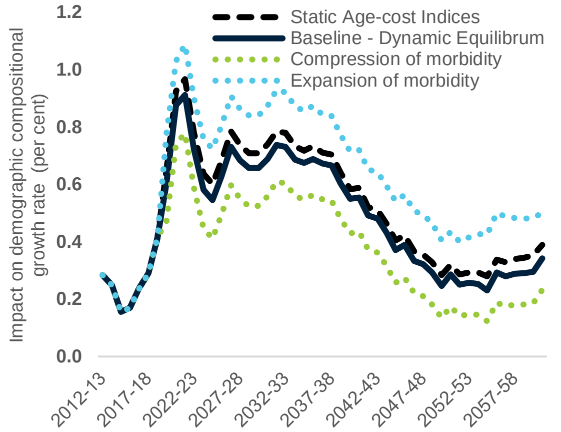


Chart 12 *Ageing impact on Outpatient services for males*

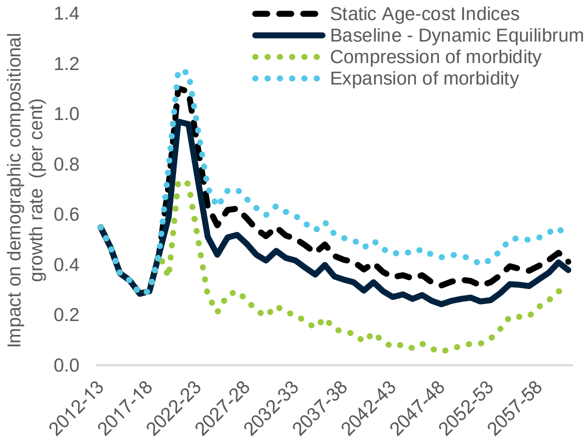


Chart 13 *Ageing impact on Outpatient services for females*

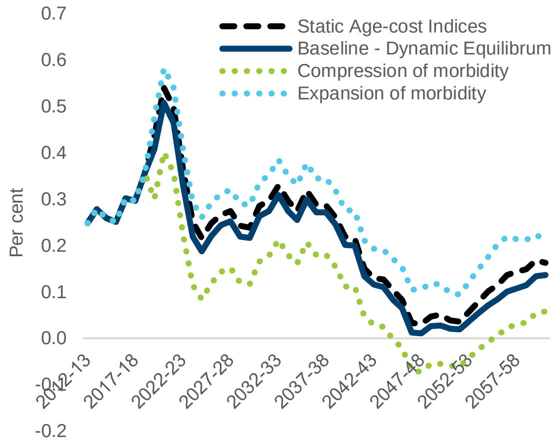


Chart 14 *Ageing impact on Community health services for males*

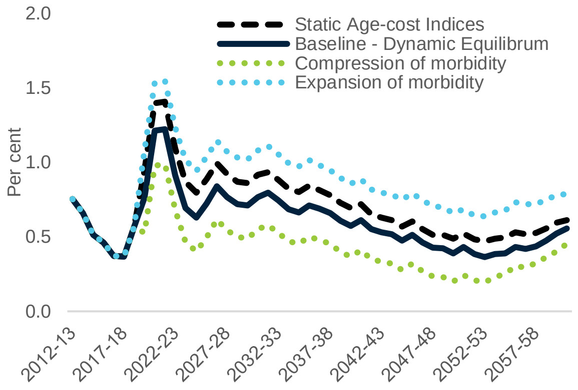
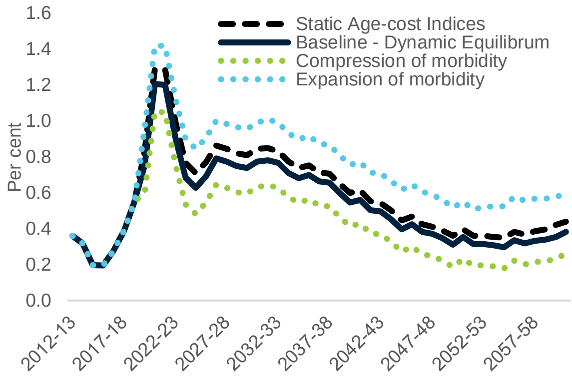


Chart 15 *Ageing impact on Community health services for females*



Note. The 'Static Age-Cost Indices Model' is used in Charts 11 to 16 rather than the 'IGR-equivalent Model' to facilitate comparison, using a consistent methodology of extending five-yearly age cohorts to age 100.

As expected, the expansion of morbidity scenario produces higher demographic compositional growth rates across all services types, compared to the proposed new baseline that assumes a 'dynamic equilibrium' morbidity trend. This scenario increases the long-term annual average health expense growth rate by around 0.22 percentage points compared to the proposed new baseline model. This is roughly equivalent to an increase in the fiscal gap of 0.36 percentage points — noting that the fiscal gap refers to the projected change in revenues less expenditures over the 40-year projection period.

Under the compression of morbidity scenario, the demographic compositional growth rates of health services are lower across all service types, compared to the baseline model that assumes a 'dynamic equilibrium' scenario. This scenario reduces the long-term average health expense growth rate by around 0.13 percentage points, broadly equivalent to a reduction in the fiscal gap of 0.24 percentage points (Table 5).

Table 5: Projected annual health expense growth and fiscal gap by morbidity scenario

	Change compared to the Baseline – 'Dynamic Equilibrium' Model	
Model	Projected long-term annual health expense growth (ppts)	Fiscal gap (ppts)
Compression of morbidity	-0.13	-0.24
Expansion of morbidity	+0.22	+0.36

Discussion

The scenario analysis illustrates that Australia's morbidity trend can have a material impact on the projected long-term health expense growth rate, and therefore the overall fiscal gap. As shown above, the difference between an 'expansion of morbidity' scenario and a 'compression of morbidity' scenario can impact the long-term annual health expense growth rate by more than 0.3 percentage points, or 0.6 per cent of GSP in the fiscal gap.

Moreover, these estimates are likely understate the impacts of population morbidity on our fiscal gap. The health of older Australians also influences their economic contribution to economic growth: healthier ageing supports improvements in both participation and productivity potential. However, the circular relationships between health status, health system pressures and the 3Ps of economic growth (Population, Participation and Productivity) are complex to model, and as such, the scenario analyses only model the impacts on health expenses.

To support fiscal sustainability and economic recovery, Governments can influence Australia's future morbidity path through policy interventions that are effective in bringing about a 'compression of morbidity' trend. That is, policy interventions that support Australians to remain healthy as life expectancy continues to increase.

However, the prevalence of chronic disease has been increasing in Australia and will shift our morbidity trend towards an 'expansion of morbidity' if left unaddressed. In 2017-18 just under half (47.3 per cent) of Australians had one or more chronic conditions, an increase from 2007-08, when that figure was 42.2 per cent.[21] Chronic diseases take time to develop and get progressively worse over an individual's lifetime, require requiring Australians to seek ongoing care.

The most effective interventions for addressing structural health expenses tend to be those that target prevention and early intervention to address and better manage the leading causes of the burden of disease for older Australians — including coronary heart disease, chronic obstructive pulmonary disease (COPD), dementia, cancer and stroke. These interventions address key risk factors including, lack of physical exercise, poor nutrition, obesity, smoking, excessive alcohol consumption, and psychological distress. Early intervention here refers both to early in the course of life (for example, measures addressing child and adult overweight and obesity), and early in the course of illness (for example, measures supporting early detection and treatment of diabetes). Other effective interventions include improving health literacy; increasing the accessibility of healthcare and the integration of care across settings including with the Commonwealth-managed aged care system, and facilitating innovations and cost-effective technologies that improve diagnostic and treatment capabilities.

It is too early to judge whether the COVID-19 pandemic will have any long-lasting impacts on morbidity and healthcare system usages. The pandemic has already brought about changes in people's behaviours and expectations for healthcare delivery and access, and changes in the way in which services are being delivered. For example, the shift towards working from home can influence physical activity patterns, and the accelerated take-up of telehealth consultations with General Practitioners and virtual care delivered by hospitals can help improve the early detection and management of chronic conditions in the right circumstances. There may also be longer-term impacts of the pandemic on mental health, particularly for younger generations who have seen their education and employment significantly disrupted. Positive changes should be embedded into the health system, and adequate and appropriate responses should continue to be delivered in a timely way to manage any longer-term challenges from the pandemic.

21 AIHW (2019), *Australian Burden of Disease Study: impact and causes of illness and death in Australia 2015,* AIHW, Canberra.

5. Conclusion

An ageing population is our 'demographic destiny' (NSW Treasury, 2016). As people at older ages are typically heavier users of the health system more due to age-related diseases particularly at the end-of-life, the 2016 IGR predicted that a population with a relatively higher proportion of older people will drive pressure on health system costs. An analysis of recently released data from AIHW that spans the period 2003 to 2015 indicates that increases in life expectancy have been accompanied by a proportionate increase in years of life spent in good health, in line with a 'dynamic equilibrium' morbidity scenario described in this report. As such, this suggests a downward revision to the degree to which population ageing drives growth in health expenses to fall, relative to the 2016 IGR, as we expect people to live healthier for longer.

The paper proposes refinements to the 2016 IGR framework to align the assumed relationship between population ageing and health spending with recent trends for consideration in the 2021 IGR. The refined methodology uses dynamic age-cost indices to reflect empirical evidence that peak morbidity is occurring later in life consistent with a 'dynamic equilibrium' morbidity scenario. The refinements are estimated to lower the projected compound annual growth rate of health expense by 0.06 percentage points over the next 40 years. This would lead to an expected reduction in the estimated fiscal gap under the 2016 IGR framework by approximately 0.12 per cent of GSP.

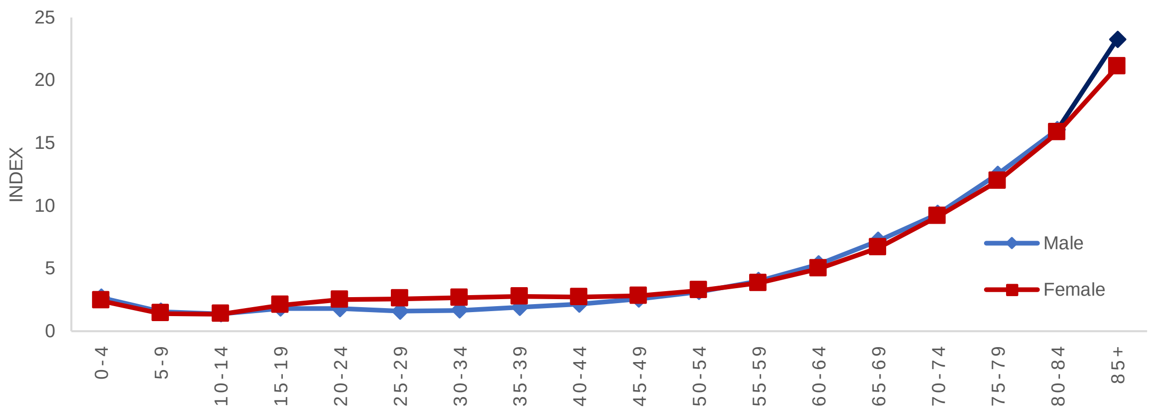
However, trends in morbidity across the population are not guaranteed — particularly in the face of the increasing burden of chronic diseases across the population. The paper examines the impact of alternative ageing scenarios on heath expense projections. Relative to a 'dynamic equilibrium' scenario, an 'expansion of morbidity' scenario is projected to result in a higher health expense growth rate equivalent to an increase the fiscal gap of 0.36 percentage points; while a 'compression of morbidity scenario' results in a long-term average health expense growth rate equivalent to a reduction in the fiscal gap of approximately 0.24 percentage points.

The alternate ageing scenarios demonstrate that policies to improve how the population ages and interacts with the health system is an integral part of any solution to fiscal sustainability; alongside efforts to improve the productivity and efficiency of the health system including an increased focus on prevention and early intervention. Improvements in health outcomes at all ages will alleviate pressure for healthcare as people enter their later stages of life, as well as support economic growth potential by enabling Australians to remain productive and participate in the workforce for longer.

Appendix A: 2016 IGR age-cost indices

Patients in acute care systems

Chart 16 *2016 IGR Age Cost Index – patients in acute care systems*

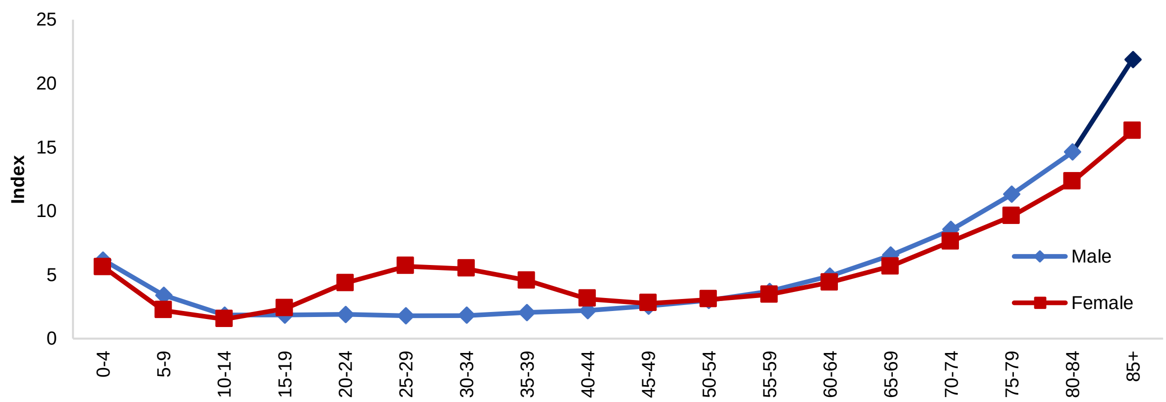


Source: NSW Treasury

For costs occurred in acute care institutions, costs are relatively high in the 0-4 age cohort as a result of hospital births. The indices for men and women diverge between the 15-19 and 40-44 age cohorts due to childbirth. The acceleration in the index in the later age cohorts reflects the increase in acute care requirements in older age, due to the onset of age-related diseases.

Community health expenses

Chart 17 *2016 IGR Age Cost Index – community health expenses*



The ‘Community Health Services’ indices similarly reflect that usage is high in the younger age cohorts as a result of child wellbeing and vaccination programs. The female index increases during the childbearing cohorts due to an increase in demand for maternity services. Again, the indices for both men and women follow an increasing trend in the older age cohorts due to an increase in demand for healthcare including palliative care.

Appendix B: Dynamic age-cost indices

Hospital services (* ACI = Age Cost Indices)

Chart 18 *Hospital services - males*

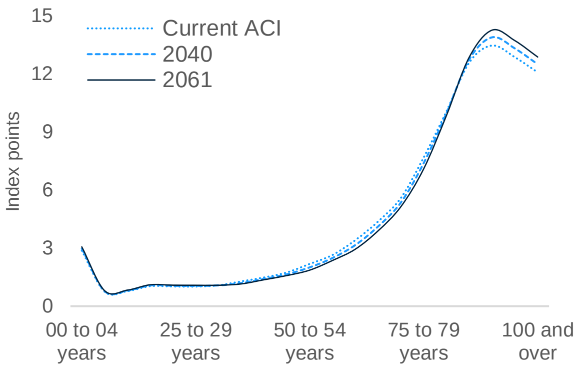
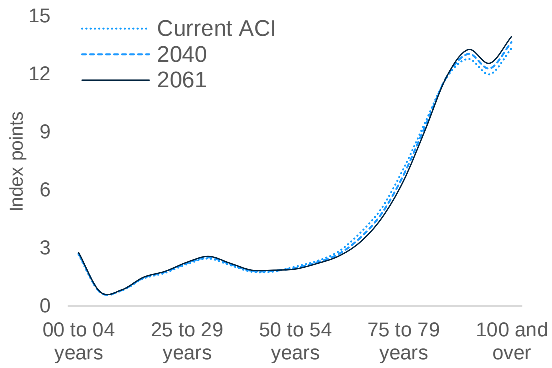


Chart 19 *Hospital services - females*



Outpatient services (* ACI = Age Cost Indices)

Chart 20 *Outpatient services - males*

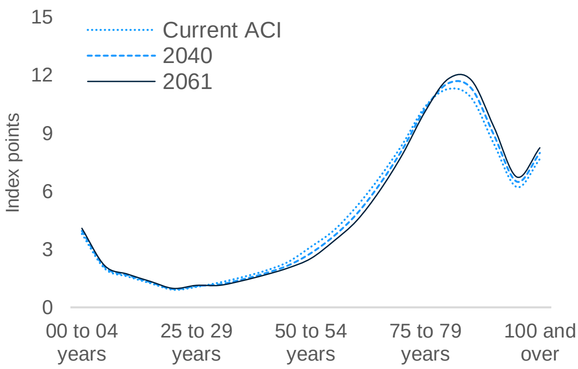
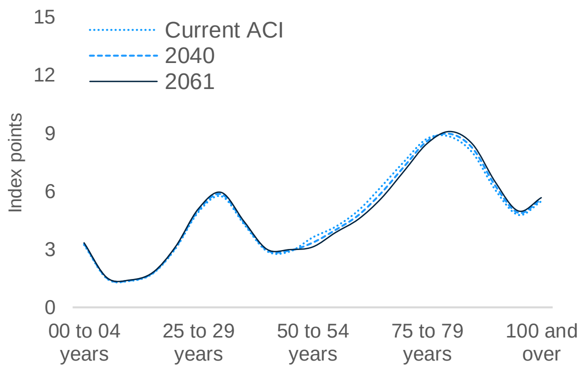


Chart 21 *Outpatient services - females*



Community health services (* ACI = Age Cost Indices)

Chart 22 *Community health – males*

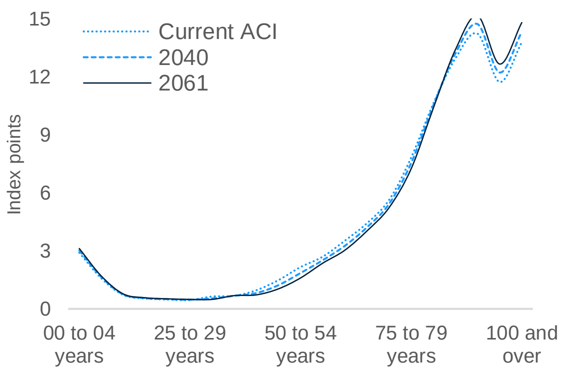
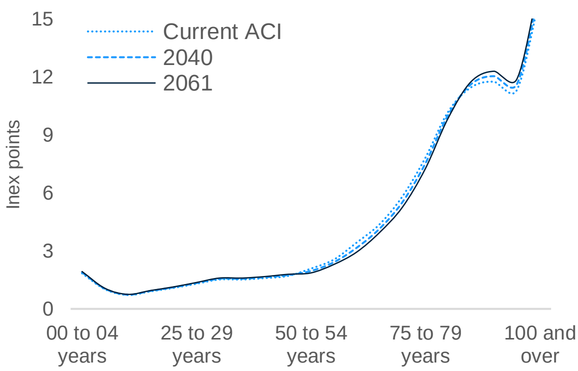


Chart 23 *Community health – females*



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