SOCIAL DEVELOPMENT DIVISION

The impact of ageing on accessibility, affordability and availability of healthcare services in Asia and the Pacific

Daniel Howdon and S. Selsah Pasali

WORKING PAPER SERIES
JUNE 2022

ESCAP 75
MOVING FORWARD TOGETHER

Disclaimer: The views expressed through the Social Development Division Working Paper Series should not be reported as representing the views of the United Nations, but asviews of the author(s). Working Papers describe research in progress by the author(s) and are published to elicit comments for further debate. They are issued without formal editing. The shaded areas of the map indicate ESCAP members and associate members. The designations employed and the presentation of material on this map do not imply the expression of anyopinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The United Nations bears no responsibility for the availabilityor functioning of URLs. Opinions, figures and estimates set forth in this publication are the responsibility of the authors and should not necessarily be considered as reflecting the viewsor carrying the endorsement of the United Nations. Any errors are the responsibility of the authors. Mention of firm names and commercial products does not imply the endorsement of the United Nations.

Please cite this paper as: Howdon, Daniel and S. Selsah Pasali. (2022). The impact of ageing on accessibility, affordability and availability of healthcare services in Asia and the Pacific. United Nations ESCAP, Social Development Division, June 2022. Bangkok.

Available at: http://www.unescap.org/kp

Tracking number: ESCAP/6-WP/50

About the author: Daniel Howdon is the lead author and a senior research fellow in health economics at the University of Leeds (UK). S.Selsah Pasali is a Social Affairs Officer at the Social Development Division of ESCAP.

Table of Contents

Abstract

The Agenda 2030 for Sustainable Development (United Nations, 2015) is a call for "[a] world with equitable and universal access to… health care and social protection, where physical, mental and social well-being are assured". While some challenges to the meeting of this goal are difficult to predict, and outwith the scope of modelling, a key potential driver of this is the changing age profile of populations.

This paper summarises the likely challenges to the delivery of this goal arising from changes in the age structure of countries in Asia and the Pacific. It then seeks to model the extent to which future healthcare expenditures (HCEs) may vary according to changes in the observable determinants of HCEs.

While modelling is subject to significant uncertainty, we provide scenario estimates of future healthcare expenditures according to variation in the age profile of populations, the extent to which future ageing may be healthier, future gross domestic product (GDP), changes in the age profile of per-capita spending, and population preferences for spending on healthcare.

Our central estimates are that HCEs as a proportion of GDP are likely to increase from around 5.3% to 9.7% by 2060, rising to 13.2% if assumptions regarding future healthy ageing do not hold. For high income countries in the region, this is likely to peak and level off at around 11% of GDP, while for medium income countries this is projected to reach 9.6% by 2060.

Keywords: healthcare expenditures, rapid ageing, Asia-Pacific

1. INTRODUCTION

Among the many goals and targets of the Agenda 2030 for Sustainable Development (United Nations, 2015) is a call for "[a] world with equitable and universal access to… health care and social protection, where physical, mental and social well-being are assured". The practical achievement of such an ambition requires not only overcoming extant challenges, and those arising before 2030, but also maintaining this in the light of potential other challenges emerging beyond 2030. While some challenges in the medium- and long-term, such as pandemics, are only predictable with huge uncertainty regarding probability of occurrence and time of occurrence, some – such as future national and regional demographic structures and the extent to which older individuals will in future age more healthily – can be predicted with substantially greater probability, with different possibilities modelled as scenarios. The Asia-Pacific region – the focus of this paper – features countries with a wide variety of levels of national income, healthcare expenditures, and current as well as likely future demographic structures.

Forming expectations regarding future demand for, access to, availability of, and cost implications for healthcare requires the consideration of multiple interlocking factors – economic, demographic, and political. This paper first sets out a schematic of each of access, availability, and expenditure in general terms in order to establish an appropriate structure for the consideration of these factors individually, before considering how they mesh together and must be seen as co-dependent in practice, and how likely trends for these in the Asia-Pacific region will create pressures on healthcare systems in the form of future healthcare expenditures (HCEs).

Demand for healthcare is presented in terms of a presentation and critique of two competing but complementary models – set out by Grossman (1972) and Dalgaard & Strulik (2014) which, to differing extents, consider an interaction between both medical and economic perspectives on health and

healthcare. Access to healthcare is considered in terms of questions of availability, accessibility, accommodation, affordability, and acceptability (Penchansky & Thomas, 1981). Availability of health is considered within this same framework. A background on healthcare expenditures is presented through a short summary of academic literature on the relationship between age, time-to-death, and healthcare expenditures (HCEs), encompassing the so-called ”red herring” thesis (Zweifel et al., 1999) and related literature on compression of morbidity (Fries, 1980; Fries et al., 2011). Finally, this paper then proceeds to consider these in the specific context of the Asia-Pacific region, before presenting an empirical model of HCEs. This empirical model takes the current situation in the Asia-Pacific region with regard to economic development, healthcare expenditures, demographic structures, and the demographic structure of healthcare expenditures, and draws on both projections on the future of these as well as academic literature in order to provide scenarios for future trends.

In this final step, future prospects for healthcare expenditures (HCEs) as a percentage of gross domestic product (GDP) – a proxy for the economic feasibility of the healthcare system to provide for population demands – are considered. These projections will provide some indication of what policymakers might expect under certain baseline scenarios and provide medium- and long-term central estimates to inform policy responses to coming fiscal pressures.

2. BACKGROUND

ACCESS TO AND AVAILABILITY OF HEALTHCARE

The earliest partial attempts in the academic literature to examine the concept of access focused merely on degree of utilisation or potential utilisation, leaving both a lack of clarity regarding whether one or both of these constitute "access" and, furthermore, how each of these were to be understood (Aday & Andersen, 1974; Gulliford et al., 2002; Cabieses & Bird, 2014). An subsequent, if still early, attempt to comprehensively formalise the concept was made by Penchansky & Thomas (1981), pointing to the then-poor definition and employment of the term. Access is broken down into various dimensions with the term defined as 'representing the degree of "fit" between the clients and the system'. These dimensions consist of "availability", describing the adequacy of supply; "accessibility", describing the appropriateness of the location of services; "accommodation", describing the extent to which supply is available at appropriate times and with appropriate means; "affordability", describing whether clients are able and willing to access services given prices, income and quality; "acceptability", describing the appropriateness of attitudes of clients and providers towards the characteristics of the other.

While Penchansky & Thomas (1981) focus their further empirical research on these concepts in a single town in the city of New York, USA, and dates back over four decades, this definition – in particular the concept of the degree of fit – encompasses much later work on the concept. These dimensions largely cover, for instance, the more expansively broken down discussion of it in a more recent critical appraisal of the topic (Cabieses & Bird, 2014), and considerations of access to new health technologies in recent years (Sieck et al., 2021). A further recent overview of systematic reviews (Dawkins et al., 2021), while not explicitly referencing Penchansky & Thomas (1981), continues to emphasise the multiplicity of factors encompassed by the concept of access. A "three delays model" for access is suggested, incorporating delays in: the decision

to seek care, reaching an adequate facility, and receiving care at the facility.

Questions of availability can be further elucidated using the framework proposed by Penchansky & Thomas (1981), in which it constitutes one dimension of access. It is described as "the relationship of the volume and type of existing services (and resources) to the clients' volume and types of needs… [and] the adequacy of supply of [specific types of medical professional]… facilities… and of specialised programs and services". This again raises several questions: whether (specific) services are provided at all, and whether they are provided in adequate volume. These require specific consideration of methods for budgetary allocation and for health technology assessment. They also require consideration of the relevant method of payment – out of pocket or via social or private insurance, cutting across the concept of "affordability" in the formulation of Penchansky & Thomas (1981).

Health technology assessment describes overall methods for judging the merits or otherwise of the provision of (chiefly, new) healthcare technologies – whether treatments, prophylactics, diagnostics, etc. Although almost all extant processes for health technology assessment involve wider considerations, a primary consideration – and the primary consideration for health economists – is that of cost-effectiveness: the question of whether the costs of a new technology are justified by the consequences of interest (commonly, the amount of health measured in quality-adjusted life years [QALYs] created, or disability-adjusted life years [DALYs] averted). This is commonly measured using an incremental cost-effectiveness ratio (ICER), denoting the extra cost per QALY generated by a new technology (Drummond et al., 2015). The availability of healthcare services, then, is determined by the size of the budget available, the cost-effectiveness of available treatments at any given time, the demand for such services, and political decisions regarding the allocation of healthcare technologies. Sivalal (2009) and Wang et al. (2021) provide a summary of methods for health technology assessment in the Asia Pacific region and of HTAsiaLink members, respectively.

The second aspect of availability described by Penchansky & Thomas (1981) – the availability of specific types of medical professional – raises questions regarding the training and retention of medical staff.

This is particularly problematic for low and middle income countries (Peñaloza et al., 2011) and a documented phenomenon in the Asia-Pacific region (Connell, 2010). While a snapshot of emigration from Africa has been well-quantified using destination countries' census data in Clemens & Pettersson (2008), less comprehensive data exists for the Asia-Pacific region, and is limited to country-specific datasets and often qualitative case studies (Muncada, 1995; Short et al., 2014). Marcus et al. (2014), in a qualitative study incorporating nine organisations in the Philippines, note that while emigration allowed for economic benefits at an individual and household (through remittances) level, it also resulted in the loss of primarily qualified and experienced nursing staff, reducing overall quality of care, particularly in rural and remote areas. Connell (2010) categorises the region (including countries broadly encompassing the UN Asia-Pacific region) into countries featuring "mainly emigration", "mainly immigration", and "minimal migration". As might be expected, low and lower-middle income countries feature heavily in the "mainly emigration" category, with high and upper-middle income countries featuring heavily in the "mainly immigration" category.

Short et al. (2014) note that the maldistribution of health workers arising from migration patterns threatens sustainable development goals, causing shortages of health workers in low- and middle-income countries. The authors again point to particular problems in rural and remote areas – including as a result of within-country migration in high income countries such as Australia. The quality of evidence regarding the ability of countries to retain prospective emigrants remains low, with a 2011 systematic review able to find only one appropriate study in this regard (Peñaloza et al., 2011).

DEMAND FOR HEALTHCARE AND HEALTHCARE EXPENDITURES

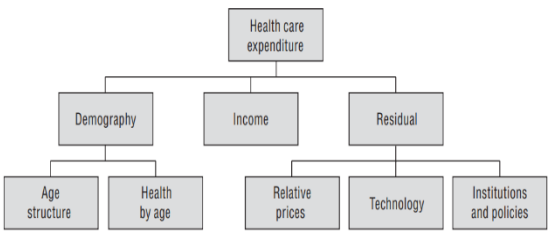
Demand for healthcare has most commonly been characterised in the economic literature using Michael Grossman's model of household production of health (Grossman, 1972). In this model, households are seen as joint producer-consumers of health, and derive their demand for healthcare from a demand for health, faced with constraints regarding their income, their available time, and the ageing process which diminishes their health (seen as a capital stock). They are seen as making decisions regarding healthcare, other expenditure, and time, as part of a comprehensive set of decisions aimed at, over their lifetime, maximising their utility – that is, getting the greatest level of satisfaction from their choice – and maximising their

returns from investment decisions. Consequently, in this model, the demand for health is seen as arising from two motivations – first, as a good providing utility, and second, as a good that allows greater investment returns. In the first case, individuals demand health simply because being healthier provides greater satisfaction, and in the second, individuals demand health because being healthier means future greater financial returns in the form of higher levels of income.

Several common predictions arise from this model and subsequent developments arising from it. First, as individuals' incomes (or expectations of future incomes) increase, they will demand a greater level of health and a greater level of (spending on) healthcare. Second, as individuals age, their health will deteriorate and larger spending on healthcare will be required in order to offset the deterioration in health that occurs over time. Third, and most generally, exogenous factors may affect the individual's ability to convert healthcare into health – for instance, a higher level of education may improve the individual's decision-making regarding health, or a public health intervention may increase the individual's level of health independent of their own decisions. More recent work in the economic literature has sought to develop an alternative conception of health, which focuses on health deficits rather than health capital, and more realistically models the ageing process. Dalgaard & Strulik (2014) attempt to derive features of individual decision-making and physiological ageing, using evidence from medical literature to explain the shape and position of the Preston curve (Preston, 1975), a well-established observation that, in cross-section, higher levels of national income are associated with higher longevity, with these increases flattening off at higher levels of income.

Demand-side pressures are clearly a large determinant of healthcare expenditures (HCEs). Forming expectations regarding the future of HCEs given an ageing population involves the consideration of multiple factors. An incomplete but useful schematic of determinants is sketched out by Maisonneuve & Martins (2015) (replicated below), consisting of demographic and non-demographic factors.

Figure 1: Determinants of healthcare expenditure



Source: Maisonneuve & Martins, 2015)

This schematic points to some key difficulties in forming such expectations. While some factors (such as age structure, and even national income) may be fairly predictable, others are much less so (such as technology, and future decisions regarding health policy). Some of these factors – such as health by age – are multi-faceted and require substantial unpicking (in this case, into expectations regarding patterns of disease, non-healthcare decisions affecting health, shocks such as the COVID-19 pandemic). "Institutions and policies" itself covers a multiplicity of determinants, constituting the way in which individual preferences – as earlier discussed as determinants of demand for health – translate into a national picture, in large part mediated through social and political processes. Most factors are interdependent: for instance, age structures may affect policies, which may affect health by age, which may affect national income. As a result, forming expectations regarding future health expenditures requires substantial assumptions, and scenario analyses adjusting these baseline assumptions.

Academic and political interest in the expected impact of demographic pressure on demand for healthcare, availability of healthcare and overall health-related HCEs dates back at least 35 years, to an International Monetary Fund report using age-stratified mean HCEs (Heller et al., 1986) to show that, in high income countries, HCEs tended to increase with age within existing populations – for instance, noting that per capita health expenditures in Japan were three times higher among individuals aged 65-69, and more than five times higher among those over 70. The report pointed to forthcoming demographic changes in the Group of Seven high income countries, suggesting that the then-forthcoming expected change Japan would see the population share of elderly rise from 9 per cent to 21 per cent by 2025, noting that "expected improvements in life expectancy are not likely to be associated with a significant reduction in morbidity… the lengthening of the human life span is likely to be associated with chronic illnesses or other disabilities, most of which will require both medical care and other forms of personal care assistance". This led to central projections of a near-doubling of the percentage of medical care expenditure on individuals aged over 60, hitting 48 per cent by 2025.

While early research & institutional reporting pointed in this direction – and while such a hypothesis is intuitively plausible – further academic research cast doubt upon the existence of an inherent nexus between population ageing and future cost increases. Of

particular relevance to this are the "red herring", beginning with Zweifel et al. (1999), and "compression of morbidity", beginning with (Fries, 1980), strands of literature. The former of these argued that age was a "red herring" in explaining healthcare costs – instead, insofar as any time variable can be said to have a causal impact on HCEs, the key variable was instead time-to-death, rather than age/time-from-birth. The implication of this is that someone, say, 70 years old and five years from death was likely to cause roughly similar HCEs to someone 80 years old and five years from death. The "compression of morbidity" framework posited, relatedly, that future trends in mortality would be accompanied by associated trends in morbidity, with the onset of chronic disease being pushed back later in life, and individuals spending (relatively or absolutely) a shorter period of their life in ill-health even as life expectancy increased. More recent work on the topic (Howdon & Rice, 2018) employing both strands of literature found that time-to-death roughly proxied for morbidity (in line with the Maisonneuve & Martins (2015) schematic emphasizing not just age but also health by age). This points to the possibility of predicting future healthcare costs using methods that incorporate scenarios for future trends in burden of disease.

3. CURRENT SITUATION

This section examines the current situation in terms of health expenditures both in 2022 US Dollar (USD) terms, and as a percentage of overall GDP. Three recent years are considered for this: 2010, 2015, and 2019, the most recent year for which data is available from World Bank (2022b), and the most recent year for which figures are not skewed by the impact of the COVID-19 pandemic. Countries in the Asia-Pacific region exhibit large variations both in total health expenditure per capita in 2022 USD terms (Figure 2), and in health expenditures as a percentage of GDP (Figure 3). Tuvalu exhibits the greatest percentage of GDP devoted to health expenditures as of 2019 – almost 25 per cent – although this varies substantially and is as low as just over 2 per cent in Brunei Darussalam. For the Asia-Pacific region, 6.15 per cent of GDP is allocated to healthcare expenditures[1].

When comparing across World Bank income groups (World Bank, 2022a), countries in higher income groups generally exhibit higher health expenditures per capita in PPP terms, as would be expected. Most countries exhibit increasing health expenditures between 2010 and 2019 in 2022 USD terms, although this trend is least obvious in countries where healthcare expenditure is highest, such as Australia and Japan (Figure 4[2]).

While the relationship between national income and percentage of national income devoted to health expenditure may be less obvious, in general higher income countries exhibit a higher proportion of national income being spent on health: this is not, however, uncomplicatedly true with Brunei Darussalam (a high-income country) spending around 2 per cent of GDP on HCEs, and Afghanistan (a low-income country) spending around 14 per cent. Broadly speaking however, this supports a view

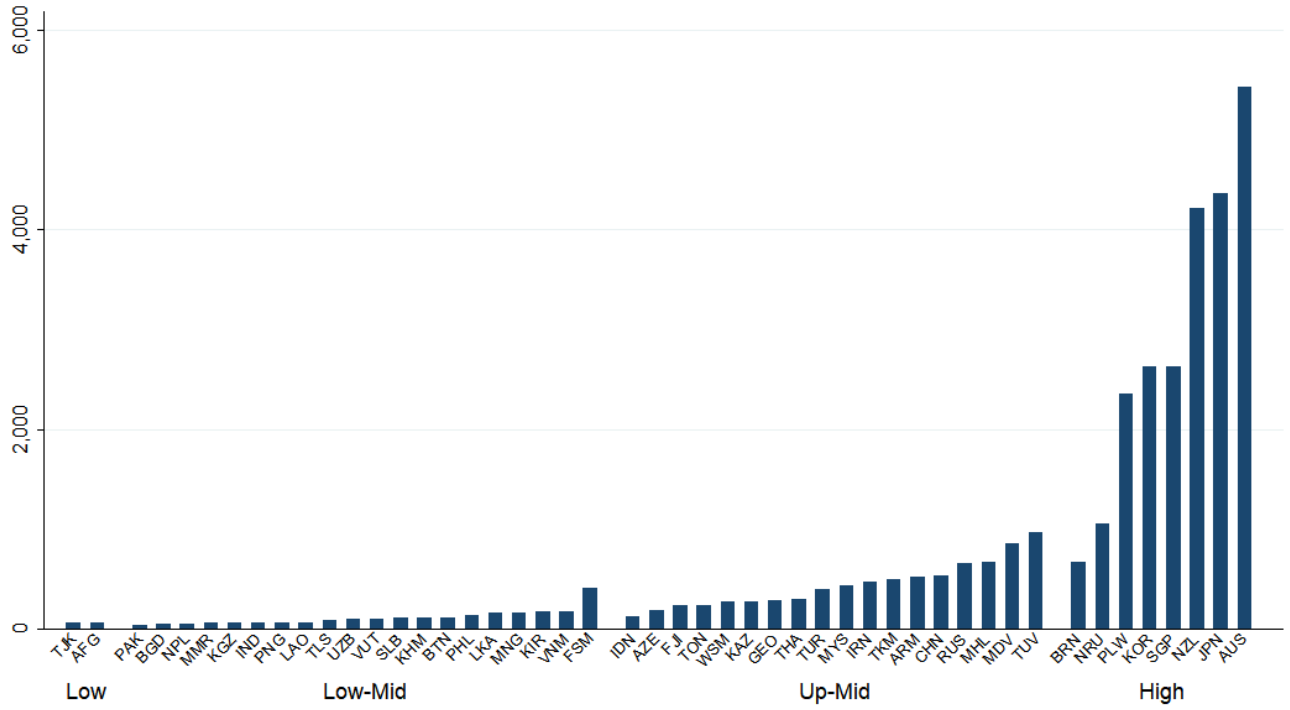
[1] Note that this differs from estimates presented later in the paper in projecting future trends: estimates for 2019 using GDP and HCE data from the World Bank are used here for current spending. In projecting future trends, a baseline year of 2020 is adopted (allowing for five-yearly estimates to 2060) using 2019 HCE data from the World Bank, along with GDP data from the IMF, which provides future GDP projections. Furthermore, as detailed later, a number of countries are later excluded from projections due to incomplete data.

[2] Note that different scales are used by income groups.

that increases in income may generally lead to greater than proportionate increases in HCEs.

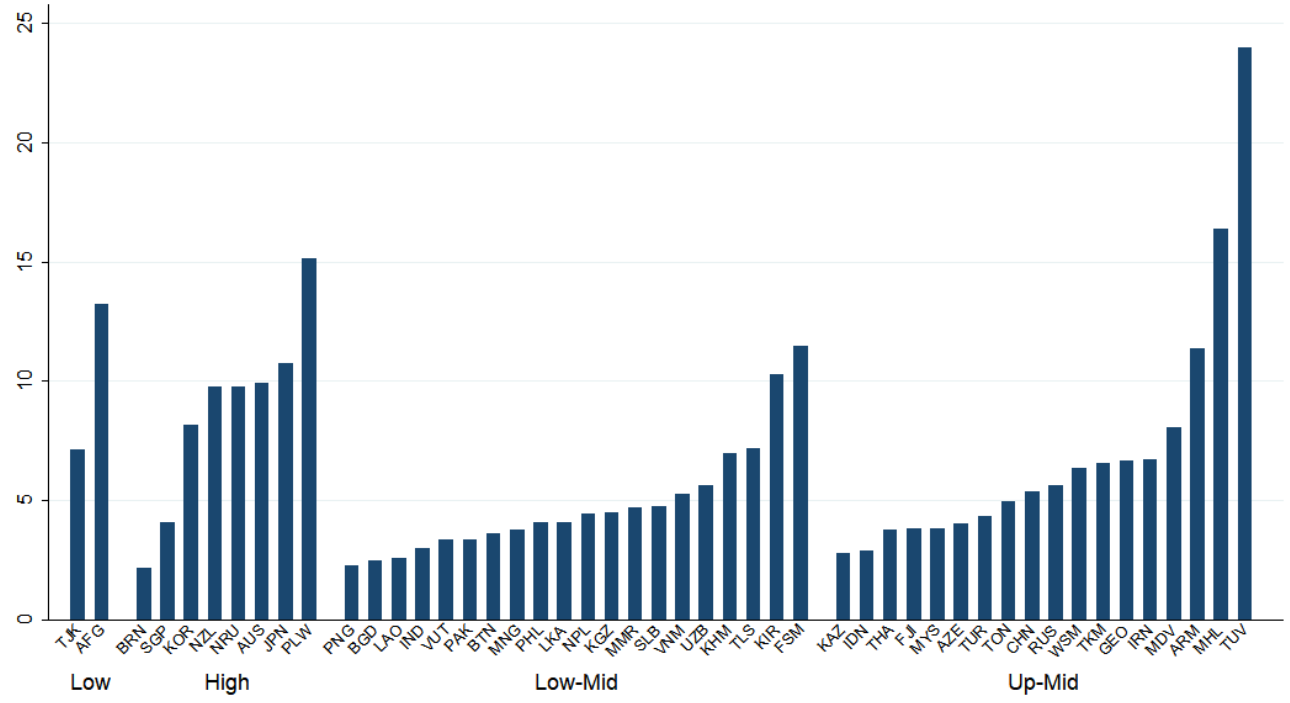
These current health expenditures can also be broken down into the proportion taken up by out-of-pocket expenditures. Again, substantial variation exists in this indicator across the Asia-Pacific region (Figure 6) with variation notable both between and within income groups (Figure 7). In general, however, out-of-pocket expenditures as percentage of all expenditures appear to be lower in high income countries.

Figure 2: Current Healthcare Expenditures, 2019 (USD)



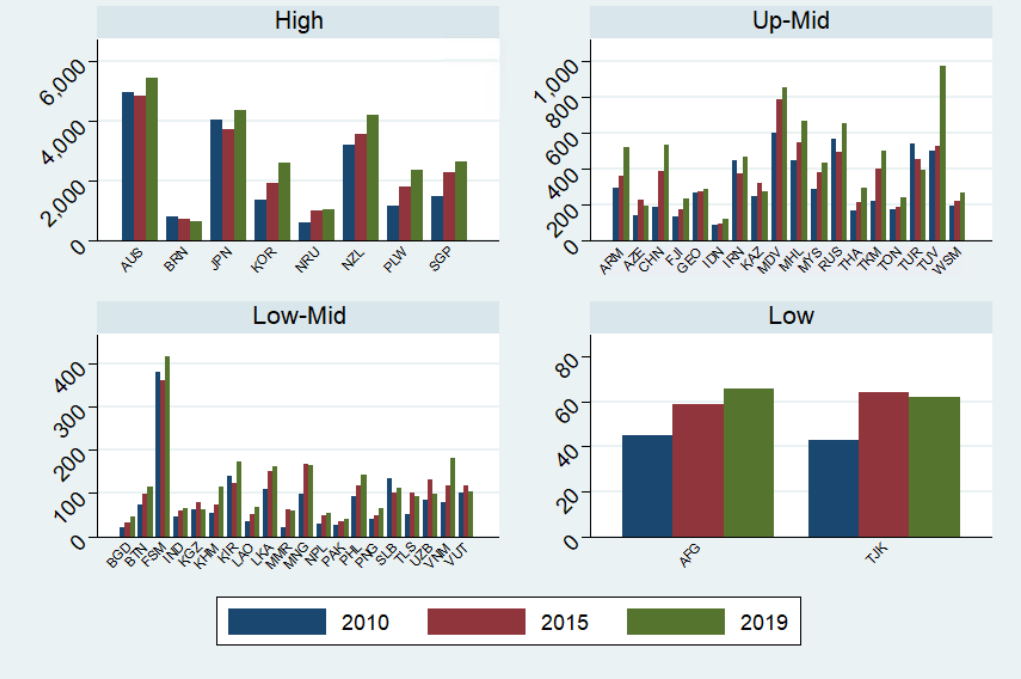
Source: World Bank

Figure 3: Current Healthcare Expenditures as % GDP



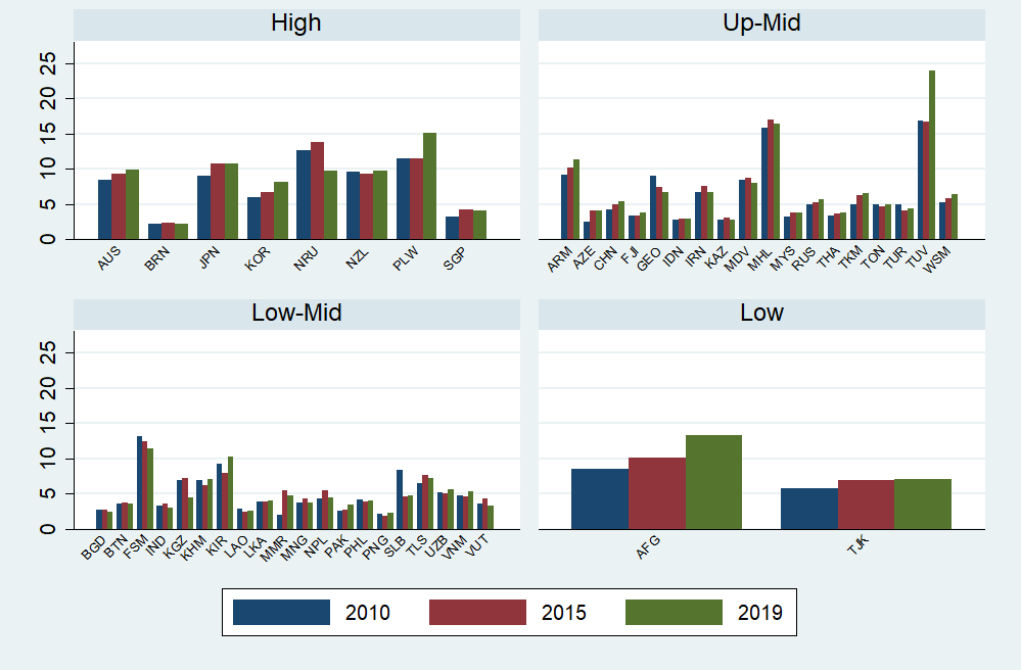
Source: World Bank

Figure 4: Current Healthcare Expenditures by World Bank income groups, 2019 (USD)



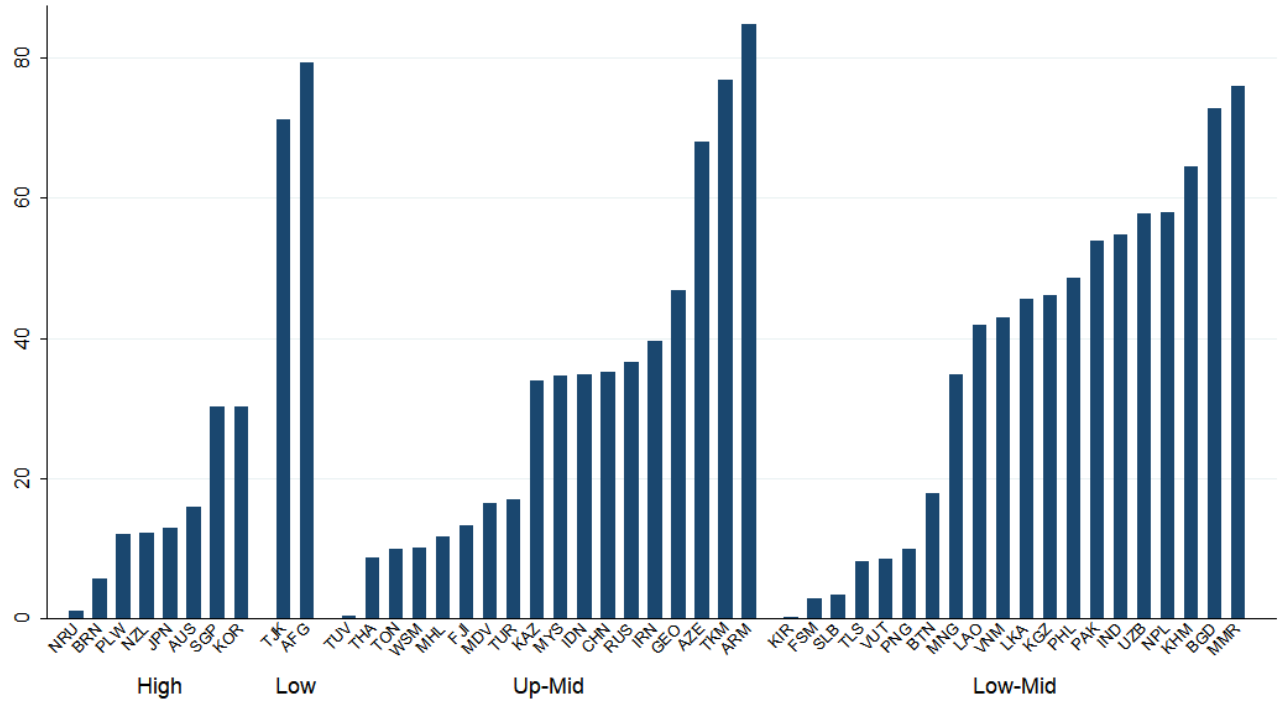
Source: World Bank

Figure 5: Current Healthcare Expenditures as % GDP



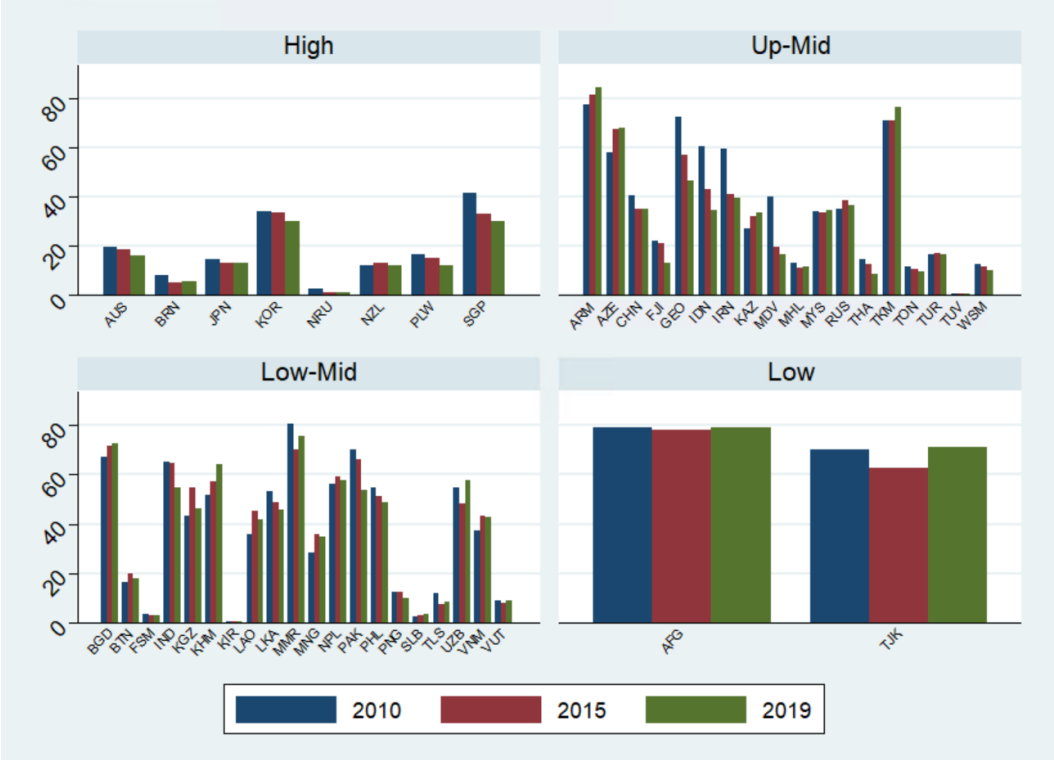
Source: World Bank

Figure 6: Out-of-pocket expenditures as percentage of total healthcare expenditures



Source: World Bank

Figure 7: Out-of-pocket expenditures as percentage of total healthcare expenditures by World Bank income groups



Source: World Bank

4. FUTURE PROSPECTS

This paper estimates several scenarios for future healthcare expenditures based on different assumptions regarding the determinants of HCEs. This forms the focus of prospects for healthcare systems, as it provides a summary of the result of the interaction of supply and demand side pressures in a quantifiable way. Extant data for the Asia-Pacific region is combined with future projections for relevant determinants of HCEs, and potential scenarios allowing for variation in these determinants. Future healthcare expenditures are seen as determined by current HCEs, potential steepening in the age distribution of per-capita HCEs independently of health, future improvements in healthy ageing, changes in the demographic profile of a country, and changes in national income and the extent to which aggregate spending on healthcare rises as national income rises.

It is worth noting that this model does not break down HCEs by the source of financing – for instance, according to out-of-pocket expenditures versus other forms of insurance-based or publicly financed provision. While variation in this is notable and clearly has important implications for the prospects of meeting sustainable development goals, the extent to which out-of-pocket expenditures versus other forms of provision are determined ultimately forms a matter for national policy. While Figure 5 shows some variation and a number of outliers in the percentage of GDP allocated to HCEs even within income group, Figure 7 shows much greater variation in the percentage of out-of-pocket expenditures: for instance, of countries in the upper-middle World Bank income group, six have out-of-pocket expenditures below 20 per cent of total HCEs, and three above 60 per cent. Within-country studies in the Asia-Pacific region such as Mahumud et al. (2017) point to individual level variation in out-of-pocket expenditures according to characteristics such as age, sex, marital status, and family wealth. An overview of such expenditures across 146 countries (Wagstaff et al., 2020) confirms the observed trend in Figure 7 that higher income countries tend to have lower out-of-pocket shares and furthermore points to the role of social policy – a strong relationship with the level of publicly-

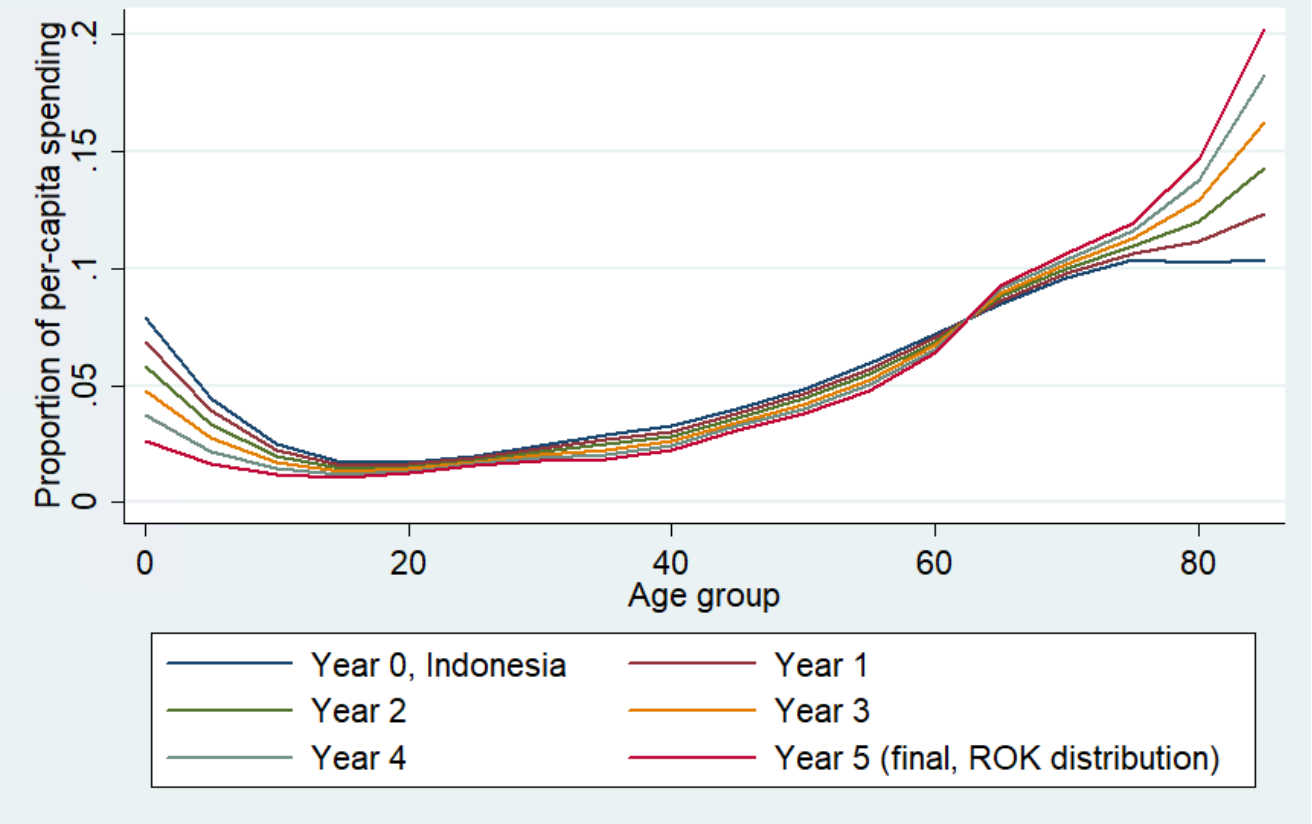
funded HCEs, as would be expected. The key role of policy here independently of demographic pressures makes future predictions on this share difficult to model. This section considers the way in which these determinants are implemented in a model of these future HCEs.

STEEPENING IN THE AGE DISTRIBUTION OF HEALTH EXPENDITURES

One commonly observed trend, both globally and in the Asia-Pacific region specifically (Ogawa et al., 2009; Williams et al., 2019), is for countries to progressively – either over time or with GDP growth – to allocate more expenditure per capita on the old relative to the young. This phenomenon (particularly when associated with time rather than GDP) is termed *steepening* (Gregersen, 2014), and refers to per-capita rather than aggregate level spending: if, for instance, aggregate health expenditures in older age groups increase solely because of demographic trends and with no increase (or even a decrease) in per capita spending, this does not constitute steepening. The impact of both demographic trends and the seemingly contradictory impact of the red herring hypothesis are considered later in this section.

A transition over time from assumed current age-stratified per capita health spending to that of a higher income country represents a further factor to be modelled in projecting future healthcare expenditures. In line with Williams et al. (2019), several different time periods are considered for which such a transition in the profile of per capita HCE costs could occur: between 5 and 40 years, although 40 years is selected as a baseline. Limitations of availability of data for age-stratified per capita HCEs mean that pragmatic choices need to be made regarding scenario analysis on this basis. Such data is more readily available in high income countries, with the OECD providing such figures for several member States including the Republic of Korea in Asia-Pacific. While Williams et al. (2019) use age-stratified per capita spending from the Netherlands as the high-income country representing a final end-state for the distribution of such spending, this paper employs this 2009 data (the most recently available) for the Republic of Korea, a high-income country in the Asia-Pacific region (World Health Organisation, 2022). Data is less readily available for low- and middle-income Asia-Pacific countries. As a result, 2005 data for public health consumption in Indonesia is used in ways detailed below.

Figure 8: Example Scenario: Five year adjustments of Indonesian (2005) age patterns of per capita HCEs to that of Republic of Korea (2009)



Source: OECD & National Transfer Accounts (ntaccounts.org)

An example of the impact of such a method is shown below in Figure 8, with a hypothetical transition from Indonesia's 2005 pattern of age-stratified HCEs to those of the Republic of Korea over a 5 year time horizon. While for the majority of age groups – particularly those between 20 and 70 – there is (in percentage point terms) little adjustment, for the 85+ age group, for instance, per-capita age group spending as a percentage of the sum of per-capita spending is expected to double from around 10 per cent to 20 per cent. In each year from year 1 to year 5, per capita healthcare expenditures get a further fifth closer to the final distribution in comparison to the original year 0 distribution. For adjustments over a greater time period – for instance over a 40 year time period as in our baseline assumptions – convergence to the same final state occurs, but at a slower rate.

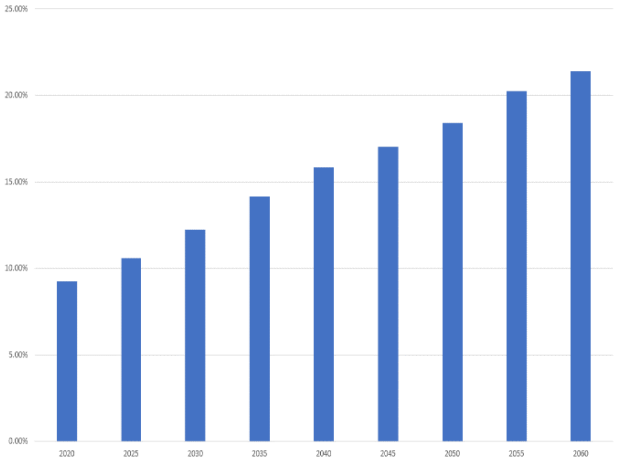
In modelling, high income countries (World Bank definition) are assumed to have a distribution of HCEs akin to that of the Republic of Korea (2009) and to maintain this distribution in future time periods. In scenarios modelling this shift in distribution of healthcare costs, countries not in this high-income bracket are assumed to begin with an

age distribution of per capita HCEs akin to that of Indonesia (2005) and to progressively move towards the Republic of Korea (2009) distribution. No such demographic shift of per capita spending on this basis is made for high income countries.

DEMOGRAPHIC TRENDS

Population structures in the Asia-Pacific region are expected to vary substantially by 2060. This paper considers both the "medium variant" and "high variant" fertility scenarios provided by the United Nations, Department of Economic and Social Affairs, Population Division, (2019).

Figure 9: Estimated proportion of population aged 65+, Asia-Pacific region (medium fertility assumptions)



Source: United Nations, Department of Economic and Social Affairs, Population Division

Of note is that these medium fertility projections imply substantially falling births over time in high income countries, with the number of individuals aged under 12 months in the Republic of Korea, for instance, falling by around 30 per cent by 2060.

On these medium fertility assumptions, the share of the overall Asia-Pacific region is expected to rise from 9.3 per cent to 21.4 per cent by 2060 (Figure 7). By contrast, the high fertility projections imply rising births over time, with the Republic of Korea, for instance, seeing an over 10 per cent rise in individuals aged under 12 months under this assumption. (Figure 9).

By contrast, the high fertility projections imply rising births over time, with the Republic of Korea, for instance, seeing an over 10 per cent rise in individuals aged under 12 months under this assumption.

HEALTHY AGEING

Further adjustment is made to allow for the potential for more healthy ageing over time, as per the red herring hypothesis regarding the relationship between population ageing and changes in HCEs. While this may appear to contradict the thesis of HCE steepening, as discussed in (Gregersen, 2014), these two hypotheses are not mutually exclusive. The red herring hypothesis is that given increasing time-to-death (and associated improvements in

morbidity), the current relationships between a given individual's HCEs and age is likely to break down or flatten. Conversely, the steepening hypothesis is that over time, per capita healthcare expenditures are likely to shift up the age group. Both of these hypotheses can hold simultaneously, taking as arguments different variables.

Projections of future time-to-death are again taken from United Nations, Department of Economic and Social Affairs, Population Division (2019), which provides past and projected estimates of remaining life expectancy by five year age group for five year periods beginning with 1950-55.

A healthy ageing adjustment is implemented by allowing the age profile of healthcare expenditures for age groups over 50 to shift downwards at least one five year age group. This means that the per capita HCE for individuals aged 50 to 55 can fall to the level of HCEs for individuals aged 45 to 50. Linear interpolation on the basis of remaining life expectancies in 2020 by age group is carried out to estimate the impact of this, following the method of Maisonneuve & Martins (2015).

As this paper provides estimates of HCEs in five year periods beginning in 2020, the estimate of remaining life expectancy for these given years is taken from the average of the two periods encompassing this year (e.g. the estimate for 2020 is given by the mean of 2015-2020 and 2020-2025).

NATIONAL INCOME GROWTH

HCEs are also likely to increase with future expected national income growth. The extent to which this is the case can be operationalised using the concept of the income elasticity of healthcare expenditures. This determines how increases in income – or GDP when seen a national level – translate into increases in HCEs, and is calculated by the percentage increase in HCEs arising from a one percent increase in income. While Maisonneuve & Martins (2015) allow for variation in this from 0.8 to 1.0 and suggest that such a range is likely to be plausible given historical data, earlier work such as Martins et al. (2006) allowed for variation in the range of 0.8 to 1.2. Consequently, scenarios allowing for an income elasticity of healthcare expenditure of 0.8, unity (1) and 1.2 are demonstrated. This means that, in these scenarios, a one percent increase in GDP is associated with a 0.8 per cent, 1 per cent, and 1.2 per cent in HCEs respectively.

Future projections of national income growth are often patchy geographically or at a national income level. OECD estimates, for instance,

exist up to 2060 for member States, and IMF estimates exist for all UN Member States up to 2026. Two alternative estimates of national income are employed in scenario analysis: extrapolating IMF estimates for 2020 to 2026 into the long term, and estimates from the Pardee Center for International Futures (data from which has been used in publications such as UN Women (2022)) up to 2060.

OTHER POTENTIAL CONSIDERATIONS

Other factors may potentially be seen as of relevance in modelling future HCEs and merit some discussion. Technological changes over time impacting on healthcare are likely to impact upon future HCEs. Such changes are, however, extremely difficult to predict and, furthermore, the impact of such changes is likely to be at least partially captured by assumptions regarding healthy ageing. It should also be noted that as scenarios, these estimates do not allow for dynamic changes in consumer preferences. Indeed, other than a single adjustment for the income elasticity of healthcare expenditures – one effect among many, the effect of which may be moderated by other HCE determinants – no explicit model of societal or individual preferences is made.

FUTURE HEALTHCARE EXPENDITURES: AN EMPIRICAL MODEL

A full model allows for variation in all of these factors. Future healthcare expenditures, absent the healthy ageing effect, are modelled according to the following equation:

$$\mathrm{HCE}_{at} = \mathrm{PCHCE}_{a,2020} \cdot (((\mathrm{GDP}_t/\mathrm{GDP}_{2020}) - 1) \cdot \epsilon + 1) \cdot S_{at} \cdot P_{at}$$

Where HCEat are healthcare expenditures for age group a in year t, PCHCEat are per capita healthcare expenditures for age group a in year t, GDPt is gross domestic product in year t, ϵ is the assumed income elasticity of healthcare expenditures (either 0.8, 1.0, or 1.2), Sat is the ratio of per capita age-related healthcare expenditures expected in year t relative to those in 2020 (the "steepening" effect), Pat is the estimated population of age group a in year t. Each of these adjustments are calculated and applied relative to baseline.

Where a healthy ageing effect is modelled, HCEs are modelled according to the following equation:

$$\mathbf{HAHCE}_{at} = \mathbf{HCE}_{at} \cdot \boldsymbol{H}_{at} + \mathbf{HCE}_{(a-5)t} \cdot (\mathbf{1} - \boldsymbol{H}_{at})$$

Where HAHCE_{at} are healthy-ageing HCEs for age group a in year t, HCE_{at} are the above-estimated HCEs without healthy-ageing adjustment, $\text{HCE}_{(a-5)t}$ are the same HCEs for the age group 5 years younger, and H_{at} is the proportionate contribution of the current age group's HCE_{at}, with $(1 - H_{at})$ representing the residual proportionate contribution of the HCEs of the age group five years younger, and H_{at} taking a maximum value of 1.

This means that, for instance, if in 2020 remaining life expectancies were 25 years for 50 to 55 year olds and 30 for 45 to 50 year olds, and by 2025 this became 26 for 50 to 55 year olds, the relative contribution to expected HCEs of 50 to 55 year olds would be (26-25)/(30-25)=20 per cent for HCEs of the 45 to 50 year old group, and 100 per cent-20 per cent=80 per cent for HCEs of the 50 to 55 year old group. This means that if, for instance, per capita HCEs for the 50 to 55 year old group were $4,000 in 2020, and per capita HCEs for the 45 to 50 year old group were $3,000, in 2025 the per capita HCEs of 50 to 55s would be assumed to be 80 per cent*$4,000+20 per cent*$3,000=$3,800 in 2025.

5. Results

Results are presented for several scenarios varying each potential determinant of HCEs outlined above. These results are presented first for the Asia-Pacific region as a whole and subsequently by country and income group. Due to problems with data availability, results are not presented for several small Asia-Pacific countries including Cook Islands, Marshall Islands, Micronesia, Nauru, Niue, Palau and Tuvalu. One larger country is also affected by these problems: Afghanistan, for which IMF GDP estimates are missing. A baseline scenario of medium fertility, an income elasticity of expenditure of unity, a healthy ageing adjustment, and a 40 year adjustment to a high income patterns of age-stratified healthcare expenditures is first presented. Full estimates by country are presented in the Appendix.

The overall profile of future real HCEs for the region for each model is for an overall monotonic increase over time, which holds irrespective of the scenario modelled. For the region as a whole, as a proportion of GDP, however, scenarios modelling a potential healthy ageing effect suggest that over time, the downward force on HCEs of the healthy ageing effect will substantially offset – but not dominate – the overall upward force of other factors. Figure 10 shows the substantial divergence in later time periods between the baseline model that adjusts for healthy ageing and the baseline model without such an adjustment. On baseline assumptions, total overall healthcare expenditures in the Asia-Pacific region is projected to rise from 5.3 per cent3 of regional income to 9.7 per cent in 2060 under the adopted healthy ageing assumptions,

[3] See footnote 1.

and 13.2 per cent making no adjustment for healthy ageing. While there is some variation at country level, the overall pattern at the regional level is of a monotonic increase, at a decreasing rate over the full time period.

The overall profile of spending for the region as a whole (Figure 10), in high income countries (Figure 11) and medium income countries4 (Figure 12) are presented below, and exhibit markedly different patterns over time. While for high income countries (Figure 11) this modelled impact is so strong that projected HCEs as a proportion of GDP stabilize from 2045 onward and starts decreasing, as 2060 approaches. It must be emphasised that the only explicit adjustment linking HCEs and GDP is a baseline adjustment for the income elasticity of expenditure, which may be dominated by other HCE determinants.

Beyond an assumption regarding the income elasticity of healthcare expenditures (in this case fixed at unity), no attempt is made to correct for societal or aggregated individual preferences regarding health. This means that if, for instance, societal preferences (howsoever determined and expressed) are closer to a Cobb-Douglas model (under which the strongest assumption would peg future healthcare expenditures to a simple constant proportion of GDP), some scenarios suggesting long-term falls in the proportion of GDP allocated to HCEs may be unrealistic.

This highlights the difficulties in projecting future healthcare expenditures, and perhaps why a one-size-fits-all set of assumptions may be inappropriate. While the profile for middle income countries seems plausible – with the overall level of HCEs as a proportion of GDP approximately doubling from 2020's 4.6 per cent to 9.6 per cent (around the general level for a high income country) by 2060 (figure 12), these baseline estimates seem slightly less plausible for high income countries, which see a projected rise from 9.6 per cent to 11.3 per cent by 2050, before gradually falling to less than 11.2 per cent by 2060 (figure 11). While the individual-level basis of Grossman (1972) may be inappropriate in fully characterising societal decisions regarding the provision of healthcare that are mediated through political processes, the insight nonetheless points to the central importance of decision-making in determining healthcare purchase and resultant health outcomes. In the case of high-income countries, historical evidence suggests that, and political pressures are likely to mean that –

[4] After the exclusion of Afghanistan due to a lack of data, Tajikistan remains as the only low income country.

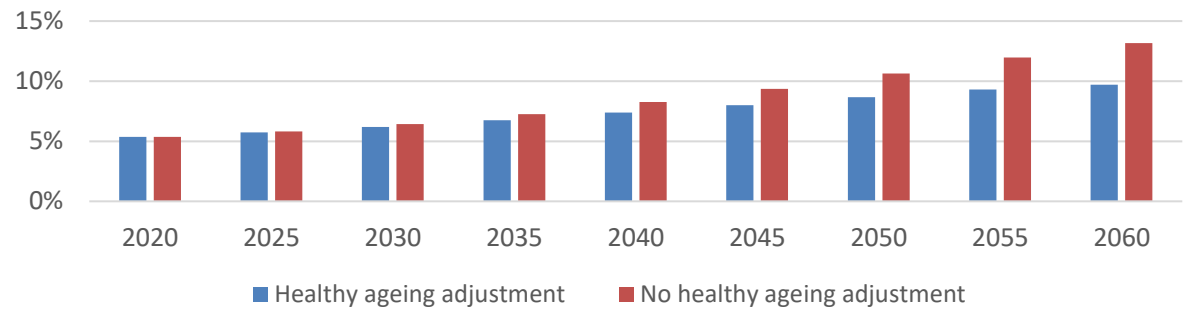
even if these estimates suggest that upward pressures from an ageing population may not be substantial – such projected falls are perhaps unlikely to result. Such estimates for high income countries are perhaps best seen as representing the headroom available for expansions of future spending and the meeting of sustainable development goals under the assumption that expected future time to death remains associated with healthy ageing in morbidity terms, and with future healthcare expenditures.

There are some important policy implications. First, while some developing countries in the region are projected to face particularly high healthcare costs by 2060, the difference is mainly a result of whether their population will follow a trajectory of healthy or standard ageing. The difference in projected health spending under these two scenarios can reach as high as 55 per cent in Maldives and Iran. In Cambodia, China, Indonesia, Mongolia, Nepal, and Tajikistan, the differential amounts to over 40 per cent.

Second, given that out-of-pocket expenditures are considerably higher in low- and middle-income countries than in high-income countries, the burden in the presence of standard aging would disproportionately fall on people and mainly so on groups in already vulnerable situations, such as older persons and workers in informal jobs who are largely unprotected in the event of life contingencies as well as health risks. Given that older persons will continue to remain active in the labour force, it is crucial that their health status is conducive to their extended years in the labor force.

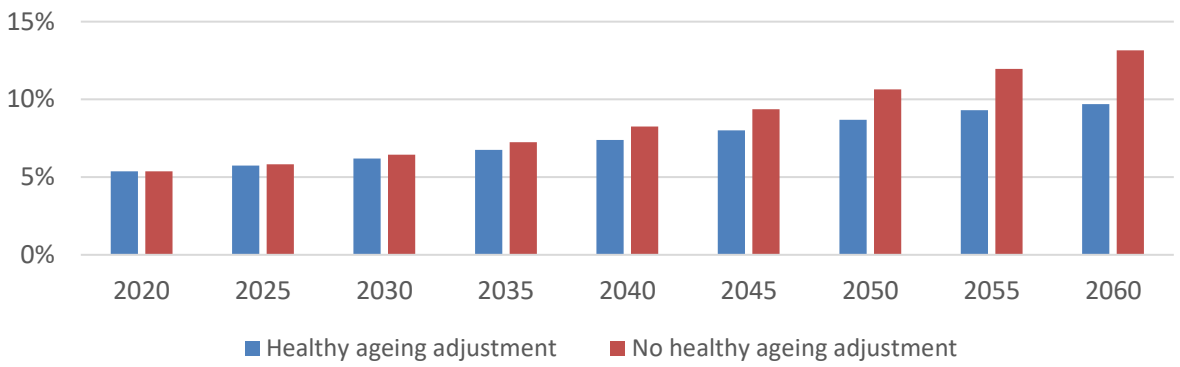
Third, accelerating progress toward universal health coverage (UHC), along with other more general health-improving measures is urgently needed to promote a healthy ageing. Ensuring access to UHC for all people ensures that service coverage in healthcare is broadened and financial protection in terms of avoiding catastrophic health spending is avoided, as enshrined in the third Sustainable Development Goal. Through, UHC governments can help improve health outcomes from early ages onward and contribute to healthy ageing thereby limiting the growth in future health spending.

Figure 10: Projected healthcare expenditures as percentage of aggregate GDP (baseline assumptions), Asia-Pacific region



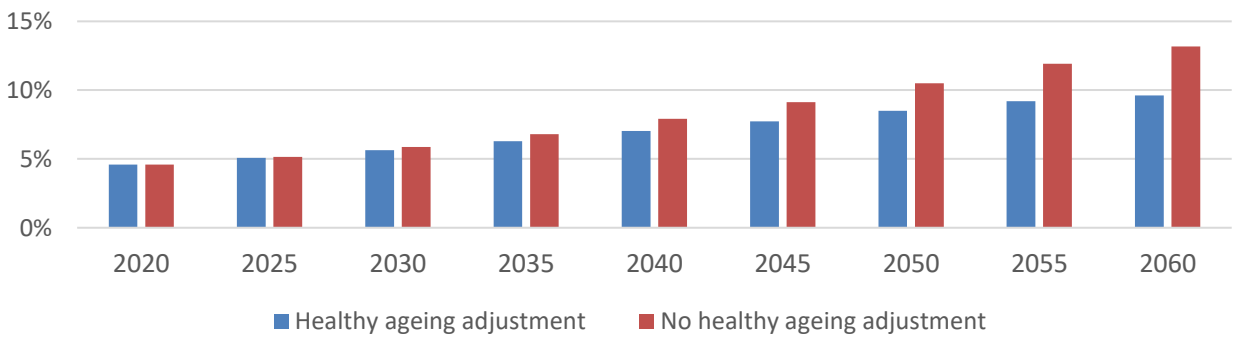
Source: Auithors' calculation based on data from WHO and DESA.

Figure 11: Projected healthcare expenditures as percentage of aggregate GDP (baseline assumptions), Asia-Pacific high income countries



Source: Auithors calculation based on data from WHO and DESA.

Figure 12: Projected healthcare expenditures as percentage of aggregate GDP (baseline assumptions), Asia-Pacific middle income countries



Source: Auithors calculation based on data from WHO and DESA.

6. CONCLUSION

This paper considers prospects for the future of healthcare systems in the Asia-Pacific region, focusing on the future of healthcare expenditures, for which significant data as well as a rich background literature is available. An empirical model of HCEs is presented which allows for a variety of factors to influence such expenditure: national income and societal preferences, population age profiles, changes in mortality, changes in how healthily populations age. These future projections imply that – if time-to-death remains as a useful proxy for morbidity – healthy ageing is likely to provide a significant brake on future growth in HCEs. For the region as a whole, the impact of healthy ageing would, under these assumptions and given future population projections, reduce the share of GDP allocated to HCEs by almost a quarter, to 9.7 per cent. In high income countries, the offsetting impact of healthy ageing means that HCEs as a proportion of GDP peak at around 11.3 per cent in 2050, before slightly falling to 11.15 per cent in 2060.

These scenarios represent only baseline possibilities: while an adjustment for income elasticity of HCEs – the extent to which HCEs increase with increases in income – is made, the model allows other factors to move either with or against the tendency of this to increase future HCEs. While the projections for middle income countries to, by 2060, reach levels of HCEs as a percentage of GDP akin to those of current high income countries, seem intuitively plausible, historical evidence suggests that political pressures may mean that long-term levelling off – or even falling – of HCEs as a percentage of GDP in high income countries may be less plausible. Nevertheless, these scenarios should prove useful to policy-makers in illustrating the potential fiscal environment in which they will operate in the long-term, and the pressures that will be faced in achieving, and maintaining, sustainable development goals by 2030 and beyond.

References

Aday, L. A., & Andersen, R. (1974). A Framework for the Study of Access to Medical Care. *Health Services Research*, *9*(3), 208–220.

Cabieses, B., & Bird, P. (2014). Glossary of Access to Health Care and Related Concepts for Low- and Middle-Income Countries (LMICs): A Critical Review of International Literature. *International Journal of Health Services*, *44*(4), 845–861. https://doi.org/10.2190/HS.44.4.j

Clemens, M. A., & Pettersson, G. (2008). New data on African health professionals abroad. *Human Resources for Health*, *6*(1), 1. https://doi.org/10.1186/1478-4491-6-1

Connell, J. (2010). *Migration of health workers in the Asia Pacific region*. Human Resources for Health Knowledge Hub, University of New South Wales Sydney.

Dalgaard, C.-J., & Strulik, H. (2014). Optimal Aging and Death: Understanding the Preston Curve. *Journal of the European Economic Association*, *12*(3), 672–701. https://doi.org/10.1111/jeea.12071

Dawkins, B., Renwick, C., Ensor, T., Shinkins, B., Jayne, D., & Meads, D. (2021). What factors affect patients' ability to access healthcare? An overview of systematic reviews. *Tropical Medicine & International Health*, *26*(10), 1177–1188. https://doi.org/10.1111/tmi.13651

Drummond, M. F., Sculpher, M. J., Claxton, K., Stoddart, G. L., & Torrance, G. W. (2015). *Methods for the economic evaluation of health care programmes*. Oxford university press.

Fries, J. F. (1980). Aging, Natural Death, and the Compression of Morbidity. *New England Journal of Medicine*, *303*(3), 130–135. https://doi.org/10.1056/NEJM198007173030304

Fries, J. F., Bruce, B., & Chakravarty, E. (2011). Compression of Morbidity 1980—2011: A Focused Review of Paradigms and Progress. *Journal of Aging Research*, *2011*, e261702. https://doi.org/10.4061/2011/261702

Gregersen, F. A. (2014). The impact of ageing on health care expenditures: A study of steepening. *The European Journal of Health Economics*, *15*(9), 979–989. https://doi.org/10.1007/s10198-013-0541-9

Grossman, M. (1972). On the Concept of Health Capital and the Demand for Health. *The Journal of Political Economy*, *80*(2), 223–255.

Gulliford, M., Figueroa-Munoz, J., Morgan, M., Hughes, D., Gibson, B., Beech, R., & Hudson, M. (2002). What does "access to health care" mean? *Journal of Health Services Research & Policy*, *7*(3), 186–188. https://doi.org/10.1258/135581902760082517

Heller, P. S., Hemming, R., Kohnert, P. W., & Feldman, R. A. (1986). *Aging and social expenditure in the major industrial countries, 1980-2025 /*. International Monetary Fund,. http://digitallibrary.un.org/record/1129

Howdon, D., & Rice, N. (2018). Health care expenditures, age, proximity to death and morbidity: Implications for an ageing population. *Journal of Health Economics*, *57*(Supplement C), 60–74. https://doi.org/10.1016/j.jhealeco.2017.11.001

Mahumud, R. A., Sarker, A. R., Sultana, M., Islam, Z., Khan, J., & Morton, A. (2017). Distribution and Determinants of Out-of-pocket Healthcare Expenditures in Bangladesh. *Journal of Preventive Medicine and Public Health*, *50*(2), 91–99. https://doi.org/10.3961/jpmph.16.089

Maisonneuve, C. de la, & Martins, J. O. (2015). The future of health and long-term care spending. *OECD Journal: Economic Studies*, *2014*(1), 61–96. https://doi.org/10.1787/eco_studies-2014-5jz0v44s66nw

Martins, J. O., De la Maisonneuve, C., & Bjornerud, S. (2006). Projections of OECD health and long-term care public expenditures. *Banca d'Italia Public Research Department Public Research Workshop, Fiscal Indicators; Banca d'Italia: Perugia, Italy*, 753–793.

Muncada, F. L. (1995). *The labor migration of Philippine nurses to the United States* [PhD Thesis]. The Catholic University of America.

Ogawa, N., Chawla, A., Matsukura, R., & Tung, A.-C. (2009). Health Expeditures and Aging in Selected Asian Countries. *Expert Group Meeting on Population Ageing, Intergenerational Transfers and Social Protection.*, *4*. https://www.ntaccounts.org/doc/repository/Naohiro%20Ogawa%20documento%20en%20ingles.pdf

Peñaloza, B., Pantoja, T., Bastías, G., Herrera, C. A., & Rada, G. (2011). Interventions to reduce emigration of health care professionals from low- and middle-income countries. *Cochrane Database of Systematic Reviews*, *9*. https://doi.org/10.1002/14651858.CD007673.pub2

Penchansky, R., & Thomas, J. W. (1981). The concept of access: Definition and relationship to consumer satisfaction. *Medical Care*, *19*(2), 127–140. https://doi.org/10.1097/00005650-198102000-00001

Preston, S. H. (1975). The Changing Relation between Mortality and Level of Economic Development. *Population Studies*, *29*(2), 231–248. https://doi.org/10.2307/2173509

Short, S. D., Marcus, K., & Quimson, G. (2014). Source country perceptions, experiences, and recommendations regarding health workforce migration: A case study from the Philippines. *Human Resources for Health*, *12*(1), 62. https://doi.org/10.1186/1478-4491-12-62

Sieck, C. J., Rastetter, M., Hefner, J. L., Glover, A. R., Magaña, C., Gray, D. M. I., Joseph, J. J., Panchal, B., & Olayiwola, J. N. (2021). The Five A's of Access for TechQuity. *Journal of Health Care for the Poor and Underserved*, *32*(2), 290–299. https://doi.org/10.1353/hpu.2021.0064

Sivalal, S. (2009). Health technology assessment in the Asia Pacific region. *International Journal of Technology Assessment in Health Care*, *25 Suppl 1*, 196–201. https://doi.org/10.1017/S0266462309090631

UN Women. (2022). *Poverty deepens for women and girls, according to latest projections*. UN Women Data Hub. https://data.unwomen.org/features/poverty-deepens-women-and-girls-

according-latest-projections

United Nations. (2015). Resolution adopted by the General Assembly on 25 September 2015. In *Transforming our world: The 2030 Agenda for Sustainable Development*. United Nations Sustainable Development Summit 2015, New York, USA.

United Nations, Department of Economic and Social Affairs, Population Division. (2019). World Population Prospects 2019. United Nations. Department of Economic and Social Affairs. *World Population Prospects 2019*.

Wagstaff, A., Eozenou, P., & Smitz, M. (2020). Out-of-Pocket Expenditures on Health: A Global Stocktake. *The World Bank Research Observer*, *35*(2), 123–157. https://doi.org/10.1093/wbro/lkz009

Wang, Y., Qiu, T., Zhou, J., Francois, C., & Toumi, M. (2021). Which Criteria are Considered and How are They Evaluated in Health Technology Assessments? A Review of Methodological Guidelines Used in Western and Asian Countries. *Applied Health Economics and Health Policy*, *19*(3), 281–304. https://doi.org/10.1007/s40258-020-00634-0

Williams, G., Cylus, J., Roubal, T., Ong, P., Barber, S., & Organization, W. H. (2019). *Sustainable health financing with an ageing population: Will population ageing lead to uncontrolled health expenditure growth?*

World Bank. (2022a). *World Bank country and lending groups*. https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

World Bank. (2022b). *World Bank Open Data*. https://data.worldbank.org/
World Health Organisation. (2022). *WHO Global Health Expenditure Database*. https://apps.who.int/nha/database/ViewData/Indicators/en

Zweifel, P., Felder, S., & Meiers, M. (1999). Ageing of population and health care expenditure: A red herring? *Health Economics*, *8*(6), 485–496. https://doi.org/10.1002/(SICI)1099-1050(199909)8:6<485::AID-HEC461>3.0.CO;2-4

Appendix

Appendix A: Baseline assumptions, HCEs as percentage of GDP

Year	2020	2025	2030	2035	2040	2045	2050	2055	2060
Armenia	11.34	12.24	13.02	14.26	15.10	15.66	15.89	16.09	16.84
Australia	9.91	10.86	11.79	12.65	13.42	14.10	14.70	15.25	15.77
Azerbaijan	4.04	4.56	5.29	6.27	7.30	8.18	8.91	9.48	10.16
Bangladesh	2.48	2.80	3.16	3.57	4.09	4.78	5.61	6.44	7.26
Bhutan	3.61	4.08	4.59	5.15	5.83	6.68	7.72	8.97	10.40
Brunei Darussalam	2.16	2.60	3.16	3.86	4.64	5.39	6.05	6.59	6.94
Cambodia	6.99	8.20	9.42	10.99	12.74	14.62	16.81	18.79	20.77
China	5.35	5.96	6.65	7.45	8.33	9.08	9.91	10.59	10.64
Fiji	3.82	4.30	4.86	5.53	6.26	7.06	7.80	8.36	8.95
Georgia	6.66	6.74	6.74	6.86	7.01	7.06	7.04	6.91	6.85
India	3.01	3.40	3.84	4.35	4.93	5.54	6.19	6.91	7.70
Indonesia	2.90	3.32	3.80	4.38	5.07	5.86	6.64	7.35	7.94
Iran	6.71	7.58	8.72	10.21	12.00	13.97	16.02	18.22	20.29
Japan	10.74	10.84	10.83	10.66	10.39	10.10	9.85	9.60	9.27
Kazakhstan	2.79	3.17	3.48	3.85	4.36	4.79	5.20	5.46	5.81
Kiribati	10.26	12.38	14.95	17.84	21.08	25.04	29.46	33.28	36.61
Kyrgyzstan	4.49	5.09	5.92	7.01	8.10	9.05	9.95	10.91	12.08
Lao PDR	2.60	2.95	3.38	3.93	4.60	5.37	6.25	7.25	8.37
Malaysia	3.83	4.47	5.19	6.05	6.98	7.99	9.04	10.11	11.26
Maldives	8.04	9.38	10.99	12.99	15.71	19.35	23.69	30.39	39.38
Mongolia	3.77	4.34	5.04	5.92	7.03	8.32	9.68	10.90	12.12
Myanmar	4.68	5.23	5.92	6.76	7.74	8.67	9.61	10.57	11.47
Nepal	4.45	5.18	5.88	6.55	7.36	8.30	9.40	10.61	11.82
New Zealand	9.74	10.63	11.53	12.31	12.95	13.44	13.76	13.92	14.00
Pakistan	3.38	3.86	4.41	5.04	5.82	6.80	7.91	9.13	10.54
Papua New Guinea	2.30	2.61	3.00	3.48	4.05	4.67	5.36	6.14	6.99
Philippines	4.08	4.77	5.56	6.52	7.59	8.76	9.98	11.26	12.62
Republic of Korea	8.16	8.97	9.79	10.61	11.33	11.86	12.01	11.78	11.26
Russian Federation	5.65	5.91	6.08	6.30	6.48	6.53	6.51	6.46	6.58
Samoa	6.36	7.00	7.83	8.87	10.12	11.49	12.80	13.89	14.73
Singapore	4.08	4.89	5.90	6.96	7.87	8.49	8.80	8.89	8.85
Solomon Islands	4.77	5.65	6.70	7.93	9.44	11.31	13.51	16.11	19.14
Sri Lanka	4.08	4.59	5.22	5.89	6.51	7.10	7.63	8.09	8.54
Tajikistan	7.11	8.26	9.85	12.11	14.73	17.53	20.22	22.94	26.00
Thailand	3.79	4.18	4.64	5.19	5.80	6.41	6.93	7.30	7.46
Timor-Leste	7.16	8.21	9.30	10.44	11.61	13.26	15.21	17.19	19.11
Tonga	4.98	5.21	5.55	6.00	6.55	7.13	7.73	8.31	8.79
Turkey	4.34	4.82	5.37	6.05	6.85	7.71	8.60	9.51	10.41
Turkmenistan	6.57	7.55	8.79	10.42	12.25	14.05	15.80	17.66	19.82
Uzbekistan	5.62	6.43	7.58	9.06	10.78	12.48	14.17	15.91	18.07
Vanuatu	3.36	3.85	4.30	5.03	5.91	6.96	8.15	9.48	10.80
Viet Nam	5.25	5.91	6.81	7.94	9.19	10.47	11.74	12.99	14.26

Appendix B: Baseline assumptions, income elasticity of HCEs set to 1.2

Year	2020	2025	2030	2035	2040	2045	2050	2055	2060
Armenia	11.34	12.96	14.33	16.11	17.37	18.24	18.68	19.03	20.00
Australia	9.91	11.38	12.78	14.06	15.21	16.20	17.07	17.85	18.58
Azerbaijan	4.04	4.75	5.68	6.88	8.17	9.28	10.24	10.99	11.86
Bangladesh	2.48	3.01	3.54	4.11	4.78	5.65	6.66	7.68	8.68
Bhutan	3.61	4.32	5.04	5.82	6.70	7.78	9.06	10.60	12.35
Brunei Darussalam	2.16	2.71	3.40	4.25	5.20	6.14	6.97	7.65	8.12
Cambodia	6.99	8.74	10.45	12.52	14.77	17.15	19.86	22.32	24.75
China	5.35	6.35	7.38	8.50	9.66	10.66	11.71	12.58	12.68
Fiji	3.82	4.54	5.32	6.22	7.17	8.19	9.13	9.86	10.60
Georgia	6.66	7.19	7.49	7.82	8.14	8.29	8.32	8.21	8.17
India	3.01	3.65	4.31	5.01	5.77	6.54	7.36	8.24	9.21
Indonesia	2.90	3.53	4.20	4.97	5.87	6.86	7.83	8.71	9.45
Iran	6.71	7.89	9.36	11.22	13.43	15.87	18.41	21.13	23.69
Japan	10.74	11.23	11.54	11.61	11.52	11.37	11.22	11.04	10.74
Kazakhstan	2.79	3.35	3.81	4.33	4.99	5.55	6.09	6.44	6.88
Kiribati	10.26	12.89	16.04	19.61	23.60	28.45	33.85	38.59	42.75
Kyrgyzstan	4.49	5.37	6.49	7.88	9.28	10.50	11.65	12.87	14.32
Lao PDR	2.60	3.13	3.73	4.44	5.30	6.26	7.35	8.58	9.95
Malaysia	3.83	4.75	5.74	6.86	8.07	9.34	10.65	11.99	13.39
Maldives	8.04	10.23	12.53	15.16	18.57	23.03	28.30	36.38	47.20
Mongolia	3.77	4.64	5.61	6.76	8.16	9.78	11.45	12.97	14.45
Myanmar	4.68	5.27	6.01	6.92	7.98	9.00	10.04	11.11	12.12
Nepal	4.45	5.49	6.47	7.41	8.47	9.67	11.06	12.55	14.05
New Zealand	9.74	11.12	12.47	13.65	14.63	15.40	15.94	16.26	16.46
Pakistan	3.38	4.08	4.85	5.69	6.70	7.93	9.29	10.80	12.52
Papua New Guinea	2.30	2.73	3.25	3.86	4.57	5.35	6.22	7.18	8.23
Philippines	4.08	5.09	6.20	7.45	8.83	10.29	11.81	13.40	15.06
Republic of Korea	8.16	9.40	10.62	11.79	12.83	13.63	13.94	13.78	13.25
Russian Federation	5.65	6.17	6.56	6.95	7.29	7.45	7.51	7.53	7.71
Samoa	6.36	7.23	8.32	9.63	11.18	12.88	14.51	15.91	17.00
Singapore	4.08	5.14	6.42	7.76	8.95	9.78	10.25	10.43	10.44
Solomon Islands	4.77	5.93	7.29	8.84	10.72	13.02	15.72	18.89	22.57
Sri Lanka	4.08	4.83	5.71	6.61	7.44	8.23	8.92	9.53	10.11
Tajikistan	7.11	8.73	10.81	13.64	16.91	20.37	23.72	27.09	30.84
Thailand	3.79	4.40	5.05	5.79	6.60	7.40	8.07	8.56	8.81
Timor-Leste	7.16	8.43	9.75	11.15	12.60	14.59	16.93	19.33	21.67
Tonga	4.98	5.41	5.94	6.58	7.31	8.08	8.86	9.61	10.25
Turkey	4.34	5.09	5.89	6.81	7.86	8.96	10.08	11.22	12.35
Turkmenistan	6.57	7.86	9.45	11.48	13.75	16.00	18.20	20.52	23.19
Uzbekistan	5.62	6.85	8.41	10.32	12.49	14.64	16.74	18.89	21.53
Vanuatu	3.36	4.03	4.66	5.59	6.69	7.99	9.45	11.09	12.71
Viet Nam	5.25	6.33	7.60	9.09	10.70	12.33	13.91	15.46	17.02

Appendix C: Baseline assumptions, income elasticity of HCEs set to 0.8

Year	2020	2025	2030	2035	2040	2045	2050	2055	2060
Armenia	11.34	11.51	11.71	12.41	12.82	13.07	13.11	13.15	13.68
Australia	9.91	10.34	10.79	11.23	11.63	11.99	12.32	12.65	12.97
Azerbaijan	4.04	4.38	4.91	5.65	6.43	7.07	7.59	7.97	8.46
Bangladesh	2.48	2.58	2.77	3.03	3.39	3.92	4.55	5.19	5.84
Bhutan	3.61	3.84	4.13	4.49	4.96	5.58	6.37	7.34	8.45
Brunei Darussalam	2.16	2.49	2.93	3.47	4.07	4.65	5.14	5.52	5.77
Cambodia	6.99	7.66	8.39	9.46	10.71	12.10	13.76	15.27	16.79
China	5.35	5.56	5.91	6.41	7.00	7.51	8.10	8.60	8.60
Fiji	3.82	4.06	4.39	4.85	5.35	5.93	6.46	6.86	7.29
Georgia	6.66	6.29	5.99	5.89	5.89	5.84	5.75	5.61	5.54
India	3.01	3.14	3.37	3.69	4.10	4.54	5.03	5.58	6.20
Indonesia	2.90	3.11	3.39	3.78	4.28	4.86	5.44	5.98	6.42
Iran	6.71	7.27	8.09	9.20	10.56	12.07	13.63	15.32	16.88
Japan	10.74	10.45	10.12	9.70	9.25	8.83	8.48	8.16	7.79
Kazakhstan	2.79	3.00	3.15	3.37	3.73	4.02	4.31	4.49	4.73
Kiribati	10.26	11.88	13.85	16.08	18.56	21.64	25.07	27.98	30.48
Kyrgyzstan	4.49	4.80	5.36	6.14	6.93	7.60	8.25	8.96	9.85
Lao PDR	2.60	2.78	3.04	3.41	3.90	4.47	5.15	5.92	6.79
Malaysia	3.83	4.19	4.64	5.23	5.90	6.64	7.42	8.24	9.12
Maldives	8.04	8.52	9.45	10.82	12.85	15.67	19.08	24.40	31.57
Mongolia	3.77	4.05	4.47	5.08	5.89	6.87	7.90	8.84	9.78
Myanmar	4.68	5.18	5.82	6.60	7.50	8.35	9.19	10.03	10.81
Nepal	4.45	4.87	5.28	5.69	6.24	6.92	7.75	8.66	9.60
New Zealand	9.74	10.15	10.59	10.97	11.27	11.48	11.58	11.58	11.55
Pakistan	3.38	3.63	3.96	4.38	4.94	5.68	6.52	7.46	8.56
Papua New Guinea	2.30	2.49	2.75	3.10	3.52	3.98	4.51	5.10	5.76
Philippines	4.08	4.44	4.93	5.59	6.36	7.22	8.14	9.13	10.19
Republic of Korea	8.16	8.55	8.97	9.43	9.83	10.10	10.08	9.77	9.26
Russian Federation	5.65	5.65	5.61	5.64	5.67	5.60	5.50	5.40	5.45
Samoa	6.36	6.76	7.35	8.12	9.07	10.11	11.08	11.88	12.46
Singapore	4.08	4.65	5.39	6.16	6.80	7.20	7.36	7.35	7.26
Solomon Islands	4.77	5.37	6.12	7.02	8.16	9.60	11.30	13.33	15.71
Sri Lanka	4.08	4.34	4.73	5.17	5.57	5.97	6.33	6.65	6.97
Tajikistan	7.11	7.79	8.89	10.58	12.56	14.68	16.73	18.80	21.16
Thailand	3.79	3.97	4.23	4.58	5.00	5.43	5.79	6.03	6.12
Timor-Leste	7.16	8.00	8.85	9.73	10.62	11.93	13.49	15.05	16.54
Tonga	4.98	5.00	5.15	5.42	5.78	6.18	6.59	7.00	7.34
Turkey	4.34	4.54	4.84	5.28	5.84	6.46	7.11	7.79	8.48
Turkmenistan	6.57	7.23	8.13	9.37	10.75	12.10	13.41	14.81	16.46
Uzbekistan	5.62	6.01	6.75	7.80	9.06	10.33	11.60	12.92	14.60
Vanuatu	3.36	3.67	3.95	4.48	5.13	5.93	6.85	7.88	8.90
Viet Nam	5.25	5.49	6.02	6.78	7.67	8.62	9.56	10.52	11.50

Appendix D: Baseline assumptions, no healthy ageing adjustment

Year	2020	2025	2030	2035	2040	2045	2050	2055	2060
Armenia	11.34	12.43	13.50	15.10	16.23	17.19	18.14	19.20	20.87
Australia	9.91	11.04	12.24	13.40	14.47	15.45	16.39	17.35	18.34
Azerbaijan	4.04	4.63	5.47	6.61	7.85	9.00	10.14	11.20	12.49
Bangladesh	2.48	2.87	3.36	3.95	4.72	5.79	7.12	8.60	10.20
Bhutan	3.61	4.18	4.84	5.61	6.57	7.79	9.32	11.19	13.39
Brunei Darussalam	2.16	2.66	3.35	4.25	5.30	6.42	7.53	8.59	9.53
Cambodia	6.99	8.36	9.88	11.93	14.38	17.35	20.95	24.95	29.32
China	5.35	6.12	7.09	8.29	9.74	11.24	12.96	14.63	15.76
Fiji	3.82	4.36	5.00	5.82	6.74	7.84	8.96	10.01	11.23
Georgia	6.66	6.87	7.02	7.32	7.69	7.98	8.27	8.44	8.73
India	3.01	3.46	3.99	4.63	5.38	6.20	7.14	8.25	9.53
Indonesia	2.90	3.40	4.02	4.81	5.84	7.11	8.54	10.11	11.78
Iran	6.71	7.75	9.22	11.26	13.92	17.20	21.11	25.90	31.36
Japan	10.74	11.04	11.26	11.28	11.13	10.98	10.88	10.78	10.59
Kazakhstan	2.79	3.25	3.69	4.22	4.97	5.69	6.53	7.21	8.13
Kiribati	10.26	12.65	15.68	19.22	23.32	28.52	34.57	40.21	45.93
Kyrgyzstan	4.49	5.17	6.17	7.54	9.04	10.51	12.17	14.05	16.53
Lao PDR	2.60	3.00	3.51	4.18	5.03	6.07	7.35	8.91	10.84
Malaysia	3.83	4.57	5.49	6.63	7.96	9.51	11.29	13.33	15.78
Maldives	8.04	9.74	12.08	15.30	20.10	27.05	36.17	47.70	61.04
Mongolia	3.77	4.44	5.34	6.54	8.15	10.20	12.56	15.05	17.82
Myanmar	4.68	5.31	6.12	7.12	8.31	9.52	10.84	12.31	13.85
Nepal	4.45	5.29	6.17	7.10	8.29	9.81	11.82	14.33	17.37
New Zealand	9.74	10.83	12.01	13.09	14.03	14.83	15.47	15.99	16.49
Pakistan	3.38	3.89	4.48	5.16	6.01	7.08	8.32	9.73	11.41
Papua New Guinea	2.30	2.65	3.12	3.71	4.43	5.28	6.30	7.53	9.03
Philippines	4.08	4.85	5.80	6.96	8.31	9.85	11.56	13.50	15.69
Republic of Korea	8.16	9.24	10.43	11.68	12.83	13.82	14.45	14.68	14.65
Russian Federation	5.65	6.04	6.37	6.76	7.13	7.38	7.65	7.85	8.27
Samoa	6.36	7.11	8.15	9.51	11.25	13.32	15.60	17.95	20.33
Singapore	4.08	5.03	6.28	7.63	8.85	9.78	10.44	10.89	11.23
Solomon Islands	4.77	5.73	6.92	8.37	10.21	12.56	15.46	19.08	23.48
Sri Lanka	4.08	4.67	5.47	6.35	7.24	8.19	9.15	10.15	11.24
Tajikistan	7.11	8.41	10.32	13.18	16.73	20.93	25.66	31.19	38.14
Thailand	3.79	4.29	4.89	5.62	6.45	7.31	8.09	8.72	9.15
Timor-Leste	7.16	8.34	9.64	11.11	12.73	15.09	18.18	21.68	25.59
Tonga	4.98	5.27	5.71	6.30	7.01	7.82	8.72	9.71	10.68
Turkey	4.34	4.94	5.69	6.67	7.88	9.28	10.86	12.62	14.54
Turkmenistan	6.57	7.63	8.99	10.79	12.82	14.89	17.00	19.36	22.15
Uzbekistan	5.62	6.50	7.76	9.42	11.41	13.51	15.78	18.30	21.53
Vanuatu	3.36	3.90	4.46	5.36	6.51	7.99	9.84	12.19	14.89
Viet Nam	5.25	5.99	7.05	8.37	9.85	11.41	12.99	14.61	16.28