Review of the Discount Rate in the PBAC Guidelines

Report

University of Technology Sydney

Centre for Health Economics Research and Evaluation (CHERE)

May 2022

Provider's Information

Centre for Health Economics Research and Evaluation (CHERE)
University of Technology Sydney (UTS) (ABN 77257686961)
O. Level 12, Building CB10, 235 Jones Street, Ultimo NSW 2007
P. CHERE, University of Technology Sydney, P.O. Box 123, Broadway NSW 2007
W. http://www.chere.uts.edu.au

Project Lead:

Professor Rosalie Viney, Director, CHERE
University of Technology Sydney
E. rosalie.viney@uts.edu.au
T. (+61) 2 9514 4722
M. (+61) 402 417 493

Table of Contents

1. Background 4
2. Timeline for PBAC advice and consultation 4
3. What is discounting? 5
3.1. Theoretical basis 5
3.2. Choosing a discount rate 6
3.3. Limitations and controversies: 7
4. International practice 9
4.1. Australian rates 9
4.2. International rates (HTA) 12
5. Arguments for change 18
5.1. Medicines Australia 18
5.2. Stakeholder submissions 20
5.3. Evaluating arguments for change 22
6. Conclusion 23
Appendix 1. Literature review 25
Appendix 2. About CHERE 26
Appendix 3. Submissions to the Review 27
References 28

1. Background

The Commonwealth Government has entered into a new Strategic Agreement in relation to reimbursement, health technology assessment (HTA) and other matters (the Agreement) with Medicines Australia, acting on behalf of the innovator medicines industry. The Agreement includes a commitment (the Review) that the Minister for Health seek the advice of the Pharmaceutical Benefits Advisory Committee (PBAC) as to whether the base-case discount rate at Section 3A.1 of the PBAC guidelines aligns with international best practice.

The Centre for Health Economics Research and Evaluation (CHERE) at the University of Technology Sydney (UTS) has been contracted by Government to provide advice to the Department of Health (the Department) and the PBAC with respect to discounting practices used in comparable jurisdictions, to assess whether the PBAC's current base-case discount rate of 5% for costs and health benefits is consistent with practices internationally and elsewhere in Government.

This Report is based on a review of recent peer-reviewed and grey literature regarding discounting practices in both HTA and non-HTA settings in Australia and internationally. The report considers economic arguments underpinning the practice of discounting and choice of discount rate, from both theoretical and practical perspectives. The report also includes a discussion of matters raised in submissions by Medicines Australia and other stakeholders to the Review [1].

The report is outlined as follows:

- Section 2 outlines the timeline for PBAC advice and consultation.
- Section 3 discusses the definition and theoretical rationale for discounting, models for establishing a discount rate and a number of controversies concerning the practice of discounting in health economic evaluations.
- Section 4 summarises current and historical discounting practices in Australia and internationally.
- Section 5 summarises issues raised in submissions by Medicines Australia and other stakeholders to the Review, provides commentary on these matters and assesses options for adjusting the PBAC base-case discount rate.
- Section 6 provides a concise conclusion and recommendations for further investigation.

2. Timeline for PBAC advice and consultation

The PBAC intends to provide advice to the Minister for Health at its July 2022 meeting. Medicines Australia provided its submission to the PBAC on 17 January 2022. The PBAC invited submissions from all stakeholders on 5 April 2022 and will invite further submissions from stakeholders upon publication of this report. That consultation will close at 9am on 30 May 2022. The PBAC will seek the advice of its economic sub-committee at its June 2022 meeting before considering all materials at its July meeting.

3. What is discounting?

Public investments often entail the accrual of costs and benefits over time. However, all else being equal, a benefit occurring immediately is generally preferable to that same benefit accruing at some time in the future. 'Discounting' is the practice of accounting for the impact of time when comparing cost and benefit streams. This adjustment, enacted through the application of a (typically non-zero, positive) discount rate, deflates the value of future costs and benefits in accordance with social time preferences, enabling a like-for-like comparison with costs and benefits that occur in the present. The choice of discount rate can have a substantial impact on the estimated cost-effectiveness of a health intervention, especially when the benefits of an intervention accrue over a long period of time [2].

3.1. Theoretical basis

Modern economic theory on discounting in health economic contexts is strongly informed by Ramsey's theory of saving and Samuelson's discount utility model [3, 4]. In practice, the discounting of future costs and outcome values assumes that society's preference for immediate utility can be encapsulated in a single discount rate.

With respect to setting a discount rate, Harrison emphasises that [2]:

> "There is little agreement about the appropriate discount rate, with cost-benefit guides, academics and textbooks giving conflicting advice. A wide range of discount rates has been recommended, with the average and bottom of that range falling over recent years." (p. ix)

In the context of an economic evaluation of public health expenditure, discounting may be understood to reflect the notion either of: 1) 'social opportunity cost'—i.e., the rate of return foregone when public expenditure diverts resources from the private capital market or 2) 'social time preference'—comprised of the so-called 'pure' preference for immediate over delayed utility, the risk of catastrophe, consumer preferences changing, technological obsolescence or macroeconomic factors that would prevent realisation of expected utility in the future, and the relative marginal utility gained through healthcare consumption given individuals' overall level of income [2].

The social opportunity cost model of discounting takes a 'descriptive' approach to establishing a discount rate. That is, the model assumes that the opportunity cost of healthcare expenditure comprises the foregone returns that this expenditure could have yielded had it been invested elsewhere in the economy [5]. When premised on social opportunity cost, the discount rate is most commonly chosen to reflect the so-called 'risk-free' market interest rate (i.e., the short-term government bond yield) [2].

In the presence of capital markets, which enable consumers to shift consumption in order to maximise utility over time, the social discount rate and market interest rate should converge [6]. Yet implied discount rates elicited through experimental methods do not systematically align with prevailing market interest rates, suggesting that individuals' actual time preferences may be based on other, unobserved criteria [6]. Further, for a particular market interest rate to be an appropriate estimate of social time preference, individuals must have free access to perfectly functioning capital markets (i.e., consumers must have perfect knowledge and incur no transaction costs), and utility from health outcomes must be equivalent to and interchangeable with other forms of utility. These assumptions are not necessarily met in reality.

Alternatively, researchers have taken a more prescriptive approach to deriving the discount rate, for example through parameterisation of the discount utility model [3, 4]. The resulting 'social time preference rate' (STPR), r, may be expressed as $r = \rho + \mu g$, where

r is the social time preference rate;

$\rho = (\delta + L)$ is the so-called 'pure' time preference rate, δ, plus the likelihood that expected benefits will not accrue due to catastrophe (e.g., natural disaster, war), changing preference, technological obsolescence, or systemic factors linking the real value of costs and benefits to income, L;

μ is a factor representing the decreasing marginal utility of health consumption relative to per-capita income; and

g is the expected annualised growth rate in per-capita income (i.e., GDP per capita) [7].

The STPR approach may be considered prescriptive in that the parameters δ, L and μ cannot be observed and must be estimated subject to normative judgements about what is ethical and in the best interests of society [2].

As summarised by Attema et al., the most prominent issues with respect to international discourse on discounting in health economic evaluation include the underlying theoretical basis for discounting, the choice of the discount rate, whether to discount costs and benefits at the same rate, and whether to vary the discount rate with time [5]. These issues are elaborated in Section 3.2.

3.2. Choosing a discount rate

Despite recent advances in empirical time preference research, there remains no international consensus about 'best-practice' in discounting with respect to the level of the discount rate or application of differential or time-variable rates.

In 1993, the US Public Health Service convened a research panel with expertise in economics, clinical medicine, ethics, and statistics to review the state of cost-effectiveness analysis and to develop recommendations for its use in health. A Second Panel on Cost-Effectiveness in Health and Medicine (the Panel) was convened in 2014 to update the recommendations of the original panel to reflect advances in HTA assessment and cost-effectiveness methodologies in the intervening period [8]. Khorasani et al. note that the Panel has been particularly influential in the setting of HTA discount rates internationally [9].

In the UK, HM Treasury's Green Book, which provides central government guidelines for appraisal and evaluation, bases its recommended discount rate for health economic evaluation on the STPR, but excludes the combined term, μg, on the basis that the 'wealth effect' is purportedly not applicable to health utility values (i.e., that the marginal utility associated with additional quality-adjusted life years (QALYs) does not decline as real income rises) [7]. In its consideration of changing the recommended reference-case discount rate, the National Institute for Health and Care Excellence (NICE) cites HM Treasury's reasoning on the (non)applicability of the wealth effect in HTA, though also cautioned that the change would entail a number of "policy and affordability challenges," including "change of healthcare costs and dynamic and distributional consequences across the health system" (p. 30) [10].

Notwithstanding UK Treasury's dismissal of the 'wealth effect' in HTA applications, the reviewed academic literature generally upheld the assumption that the marginal utility gained from the

consumption of healthcare is related to consumers' income and, by extension, their level of healthcare consumption and baseline health status (see, for example, Frederick et al., 2002) [6]. Health outcomes depend strongly on the timing of the consumption of healthcare with respect to current health states. The marginal utility gained from consuming a lifesaving medicine when very ill, for example, is likely to be higher than the marginal utility gained from consuming an equivalent resource value of healthcare when one is already quite healthy.

Finally, even assuming that the marginal utility of healthcare consumption does not decrease with respect to income, inclusion of the combined term, μg, in the discount rate is still appropriate. Constant utility of healthcare consumption with respect to income implies a value of $\mu = 1$, not zero. Likewise, assuming that the marginal utility of healthcare increases with respect to income implies a value of μ between 0 and 1. In either case, approximation of the discount rate should continue to account for the expected growth in national income (i.e., GDP per capita), g, as well as the marginal utility associated with consumption, μ. Empirical estimates of the elasticity of marginal utility in highly developed economies suggest mean value for μ of 1.35 to 1.4 [11] (in Haacker et al., 2020).

Equal vs differential discounting—Decision-makers may choose to apply either a single discount rate or different rates to costs and benefits (i.e., 'equal' and 'differential' discounting, respectively). Differential discounting is supported by empirical evidence that society's willingness-to-pay for health is increasing with income growth over time [12-14] (in Attema et al., 2018). Notwithstanding this argument, discounting practices in HTA internationally overwhelmingly favour the application of equal discounting (see Section 4.2). Attema et al. argue that this convention has largely been influenced by Weinstein and Stason's consistency argument and Keeler and Cretin's postponement paradox [15, 16]. Weinstein and Stason's work showed that differential discounting may distort the estimated value of identical interventions delivered at different times, while Keeler and Cretin argued that discounting health benefits at a lower rate than costs may imply that the economically optimal decision is to delay expenditure indefinitely.

Constant vs time-variable discounting—In the standard discount utility model, time preferences are assumed to be independent of the time interval—a consumer is assumed, for example, to discount an expected future value by the same rate per annum, regardless of whether that value accrues one year or ten years into the future [17]. Yet recent research supports the hypothesis that the rate at which individuals discount utility values tends to decrease with the length of time over which those values are estimated [17-19]. Notwithstanding growing empirical support for variable discounting, however, most international HTA guidelines continue to recommend the use of constant discounting (see Section 4.2) [5].

As summarised by Attema et al. [5]:

> "No matter what model is chosen, there will necessarily be normative decisions about perspective (social vs individual), costs and benefits (equal vs differential), and time impacts (constant, tiered, hyperbolic) that will have significant impacts on the rate and, by extension, the outcome of cost-effectiveness evaluations." (p.750)

3.3. Limitations and controversies:

Lack of empirical basis—The discount utility model is a long-established tool to promote economic efficiency in public decision-making. Nonetheless, Frederick et al. observe that "virtually every

assumption underlying the discount utility model has been tested and found to be descriptively invalid in at least some situations" and that the significant body of international literature on discount rates has failed to reconcile the wide range of empirical estimates [6]. Indeed, key underlying components of the discount rate, including the marginal productivity of healthcare spending and consumption value of health, among others, lack accepted empirical estimates [5].

Frederick et al. also observe that the theoretical assumptions of the discount utility model often diverge from human decision-making in reality, namely, that the discount utility model characterises health as discrete bundles that are experienced instantaneously and without consumers adjusting their preferences and consumption in anticipation of future utility [6].

Health as a special case—As noted by Attema et al., some researchers have argued against discounting in health contexts on the basis that health is a unique commodity that cannot be traded over time and should therefore not be subject to the same opportunity cost considerations relevant to other forms of public investment. The authors counter that healthcare resources, whose consumption leads to health benefits, can be traded across time, and that healthcare resources and benefits are therefore both subject to discounting [5].

Equity—Some reviewed academic literature provided qualified support for a lower discount rate in the presence of significant intergenerational consequences in some circumstances [20]. Nonetheless, in the event that health expenditures undertaken today contribute to a greater baseline level of productivity, income and population health in the future, depressing the discount rate to promote particular classes of interventions may actually leave future generations worse off, if alternative investments could have yielded greater overall health benefits [2]. Further, the implications of the discount rate on equity are not straightforward; individuals' time-preferences tend to be negatively correlated with income, with low-income households generally reporting higher time-preference than high-income households [2]. Hence even an empirically substantiated mean social discount rate would not necessarily reflect the time preferences of different groups within the population, particularly with respect to relative socio-economic (dis)advantage. Reviewed Australian Government guidance on discounting stresses that intergenerational equity and welfare should not be addressed by adjusting the discount rate [2, 21].

Uncertainty of social opportunity cost—Where the private market interest rate is used as a proxy for the social opportunity cost of public investment, some researchers advocate a downward adjustment of the discount rate to reflect "market distortions and inefficiencies in intergenerational transfers" [22, 23] (in Attema et al., 2018). The reviewed literature did not establish the appropriate magnitude for such an adjustment with respect to the discounting of intergenerational health values.

Uncertainty of benefits—Assessments of the expected benefits of health interventions do not typically address the uncertainty that such benefits will actually accrue (i.e., the non-diversifiable project-risk of a health intervention) [24]. Yet intrinsic to the tabulation of a health intervention's expected benefits is some level of uncertainty linked, inter alia, to the statistical power of the clinical trial, the estimated treatment effect (reflected in a confidence interval), treatment adherence in real-world settings, and changes in technology or health outcomes that prevent benefits from accruing as predicted.

Notwithstanding recent theoretical work in this area, the incorporation of a project-specific risk term in the discount rate—using the consumption-based capital asset pricing model (CCAPM), for

example—is not observed internationally in common practice or in official health economic evaluation guidelines [24]. Harrison cautions that uncertainty in the estimation of costs and outcome values should not be addressed through an adjustment of the discount rate [2]. Because health interventions are likely to have unique uncertainty profiles based on the type and form of intervention, target population, time horizon and other characteristics, these various parameters are not readily captured in a single premium applicable across projects. Including intervention-specific uncertainty in the discount rate would therefore necessitate each cost-effectiveness evaluation to apply its own bespoke rate, which would likely undermine one of core tenets of discounting: to allow comparability between interventions over time. Project-specific risk and uncertainty of health outcomes may therefore be more aptly addressed in the direct appraisal of an intervention's expected costs and health outcomes [2, 7] or through sensitivity analyses of the economic evaluation's model parameters [25].

Double discounting—Attema et al. caution the risk of 'double-counting' consumers' time preferences. Specifically, QALY values elicited through some stated preference methods (e.g., time trade-off) may already reflect consumers' time preferences and should arguably not be discounted further [5, 26, 27]. Decreasing (or eliminating) the discount rate applied to health values to mitigate perceived double discounting would imply differential discounting of costs and health benefits.

Changing social value of health—A number of researchers contend that society's willingness-to-pay for health is expected to increase with time (and national income), warranting a downward adjustment of the discount rate to reflect the increasing marginal utility of healthcare consumption. This adjustment would likewise imply differential discounting of costs and health benefits [12-14, 28] (in Attema et al., 2018).

4. International practice

A systematic review was undertaken of recent international peer-reviewed and grey literature regarding discounting models, rates and rationales in Australia and internationally, in HTA settings. The literature review informs this Report's assessment of the alignment of the PBAC's current guidelines with those of comparable jurisdictions internationally, and potential implications for Government decision-making of changes to the discount rate, based on economic theory.

Methods of the literature review, including search terms, exclusion criteria and results are presented in Appendix 1.

4.1. Australian rates

Discounting is a long-established practice in a range of public investment and planning contexts throughout Australia at the local council, state and federal levels. Outside the domain of HTA, since 1980, a standard discount rate of 7% has been used in most Australian governmental guidelines for cost-benefit analyses and other economic appraisals. Various arguments against continued usage of this discount rate have stressed that 7% is high relative to the rate used in comparable countries such as the UK, and do not consider changed economic conditions over time or uncertainty around the theoretical basis for the choice of the rate [29]. In 2018, Applied Economics, the Grattan Institute and the House of Representatives Standing Committee on Infrastructure variously recommended discount rates ranging from 3.5% to 6.5% in the context of built infrastructure, primarily on the basis that

discounting reflects the social opportunity cost of investment and that real borrowing rates are a key component of the discount rate [30-32]. An overview of contemporary suggested discount rates in Australia, settings and recommending agencies is presented in Table 1.

Table 1. Discount rates in Australian public decision-making

Recommending Agency	Australian setting	Year of publication	Discount rate(%)	NOTE
Productivity Commision (Harrison, 2010)	Government wide discount rate	2010	8	senstivity analysis using the discount rate of 3%-10 %
Technical Guidelines on Economic Evaluation , Department of Treasury and Finance [DTF]- Victorian Government	For goods and services in traditional core public service delivery areas where benefits can be articulated but not easily quantifiable in monetary terms (education, justice and public health)	2013	4	
	For goods and services in traditional core public delivery areas of government (i.e. non- commercial investments) where benefits attributed to the project are more easily quantifiable in monetary terms (housing, public transport and roads)		7	
	Commercial investments with risk similar to private sector		Consult with DTF to determine rate	
Office of Best Practice Regulation [OBPR], Department of the Prime Minister and Cabinet [PM&C]	Government wide discount rate	2014	7	senstivity analysis using the discount rate of 3%-10 %. **This rate has been reported to be in use since 1980** (Hone et al., 2022).
NSW Government Guide to Cost Benefit Analysis , The Treasury, NSW Government	Across all economic evaulations or appraisals	2017	7	senstivity testing to be undertaken at 3% and 10%
Build Up and Moving Out report, House of Representatives Standing Committee on Infrastructure, Transport and Cities (Parliament of the Commonwealth of Australia)	Infrastructure	2018	4	
Choosing the Social Discount Rate for Australia , Applied Economics (Abelson & Dalton, 2018)	All sectors across all states and territories	2018	6.5	senstivity analysis using the discount rate of 4.5%- 8.5%
Grattan Institute (Terril & Batrouney, 2018)	Transport infrastructure projects with very low systematic risk- buses, roads, urban passenger rail	2018	3.5	
	Transport infrastructure projects with somewhat low systematic risk- ferries, freight rail		5	

Source: [2, 21, 29-34]

In the domain of public health in Australia, the PBAC reviews the clinical effectiveness, safety and cost-effectiveness of new medicines relative to other treatments in order to provide recommendations to Government on the inclusion of new medicines for subsidy under the Pharmaceutical Benefits Scheme (PBS). The PBAC's Guidelines for preparing a submission to the Pharmaceutical Benefits Advisory Committee (3A.1.5) instruct sponsors to [35]:

- Discount both costs and health benefits at a uniform, annual (compounding) rate of 5% per year for all costs and health benefits that occur or extend beyond one year in the base-case.
- Present sensitivity analyses using fixed discount rates of 3.5%, and 0% per year (applied to both costs and benefits).
- If relevant, present supplementary analyses using other discounting methodologies (e.g., a different uniform rate, differential rates, time-varying rates) and justify the alternative approach.

In 1990, the (former) Department of Health, Housing, Local Government and Community Services recommended the use of health economic analysis as a requisite for the inclusion of new therapies on the PBS. At the time, the use of international benchmarking was deemed practically necessary due to the then lack of health economic expertise and empirical estimates of willingness-to-pay in Australia [36]. It was also acknowledged that the evidence produced in health economic evaluations of therapeutic efficacy and effectiveness abroad would likely be used by transnational pharmaceutical companies in their submissions to the PBAC, and that benchmarking techniques and model parameters against those used in international settings would facilitate comparability [36].

Importantly, the Department of Health, Housing, Local Government and Community Services made clear that the 'true' rate of social time preference was presumed to be unknown, with the recommended 5% discount rate representing the mid-point of a wide confidence interval [36].

> "Uncertainty surrounds not only the discount rate but many of the other variables used in the calculations as well. […] Judgement must be used in determining the key parameters to be used in a sensitivity analysis, but an obvious candidate is the discount rate. The sensitivity analysis might redo the calculations using discount rates of 3% and 8%, reasonable lower and upper limits of the uncertain true rate." (p.43)

4.2. International rates (HTA)

The Panel (2016) recommended equal discounting of costs and health benefits at a real rate of 3%, as well as sensitivity analyses using a "reasonable" range of rates (p. 1098) [8].

In the UK, HM Treasury's Green Book sets the real STPR for use in discounting health interventions at 1.5%. It cites 'plausible' estimates for the pure rate of time preference and catastrophic risk of 0-1% and 1%, respectively, excluding an estimated 'wealth effect' premium of 2% (see Section 3.2) [7]. HM Treasury also specifies declining health discount factors for long-term assessment of health interventions due to uncertainty in the value of [the STPR's] components: Year 0-30 (1.5%, 1% where social time preference (STP) = 0); Year 31-75 (1.29%, 0.86% where STP = 0); Year 76-125 (1.07%, 0.71% where STP = 0) [7]. Notwithstanding HM Treasury's position, in its 2022 Health Technology Evaluations manual, NICE maintained its recommended reference-case discount rate for both costs and benefits at 3.5%, with a rate of 1.5% for costs and benefits to be presented alongside the reference-case in prescribed circumstances (i.e., the technology is for people who would otherwise

die or have a very severely impaired life, it is likely to restore them to full or near-full health, and the benefits are likely to be sustained over a very long period) [37]. In its determination to maintain its reference-case discount rate of 3.5% for costs and health outcomes, NICE noted that [38],

> there is an evidence-based case for changing the reference-case discount rate to 1.5% for costs and health effects, but because of the wider policy and fiscal implications and interdependencies […], no change to the reference-case discount rate can be made. (p.38)

Khorasani et al. conducted a systematic historical review of HTA guidelines, covering the discount rates (and underlying rationales) recommended in 48 countries [9]. The authors found that from 1990 to 2018:

- 38 countries (79%) consistently applied equal discounting to both costs and health benefits, including the US, Canada and most European nations.
- Discount rates in 13 countries (27%) trended downward, including in the US, UK and Finland. Nine countries (19%), including Australia, Scotland and Sweden, did not alter their discount rates over that time. Ireland adjusted its rate upward. Six countries (12.5%), including Switzerland and France, adjusted their rates upward and downward over that time.
- The most common rationale provided for the choice of the discount rate value included reference to the country's finance ministry guidelines, followed by comparability between studies and discount rates in other national HTA guidelines.

Haacker et al. (2020) report that in a sample of 188 economic evaluations of health interventions in low and middle-income countries, 159 (85%) studies used a discount rate of 3% for both costs and health benefits [39]. The authors note that countries' choice of discount rate was most often premised on the borrowing costs of government or general guidance not specific to health, with limited discretionary downward adjustments to the rate for interventions with high up-front costs and long-term realisation of benefits [39].

For the present review, the historical rate data presented by Khorasani et al. were updated for a subset of 19 economically similar countries with established HTA practices, including Australia. Results are presented in Table 2.

Table 2. HTA discount rate by country (1990 - 2021)

Country	Discount rate (%)	1990-94	1995-99	2000-04	2005-09	2010-14	2015-19	2020-21
Australia	Cost	5	5	5	5		5	5
	Benefit	5	5	5	5		5	5
Belgium	Cost		5		3	3		3
	Benefit		5		1.5	1.5		1.5
Brazil	Cost				5	5		5
	Benefit				5	5		5
Canada	Cost	5	5		5		1.5	1.5
	Benefit	5	5		5		1.5	1.5
France	Cost		2.5 - 5	2.5 or 5		4		4
				0, 3, 5				
	Benefit		0	0, 3, 5		4		4
Germany	Cost		5	5	5	3	3	3
					3			
	Benefit		5	5	5	3	3	3
					3			
Ireland	Cost					4	5	4
						5		
	Benefit					4	5	4
						5		
Japan	Cost						2	2
	Benefit						2	2
New Zealand	Cost		10		8	3.5	3.5	3.5
					3.5			
	Benefit		10		8	3.5	3.5	3.5
					3.5			
Scotland	Cost				3.5	3.5	3.5	3.5
	Benefit				3.5	3.5	3.5	3.5
Singapore	Cost						3	3
	Benefit						3	3
South Africa	Cost					5		5
	Benefit					5		5
South Korea	Cost				5	5		5
	Benefit				5	5		5
Sweden	Cost			3		3	3	3
	Benefit			3		3	3	3
Taiwan	Cost				5			5
	Benefit				5			5
Thailand	Cost				3			3
	Benefit				3			3
The Netherlands	Cost		4	4	4	4	4	4
	Benefit		4	4	1.5	1.5	1.5, 4	1.5
UK (England and Wales)	Cost	6, 0	6	6	3.5	3.5	3.5	3.5
				3.5				
	Benefit	6, 0	0	1.5	3.5	3.5	3.5	3.5
				3.5				
USA	Cost	7	3, 5	3, 5	3, 5	3	3, 5	3
	Benefit	7	3, 5	3, 5	3, 5	3	3, 5	3

Notes: Missing values not specified in the country-specific documents. Multiple rates were reported in some instances. In England and Wales, NICE recommends a reference-case discount rate of 3.5% for costs and benefits.

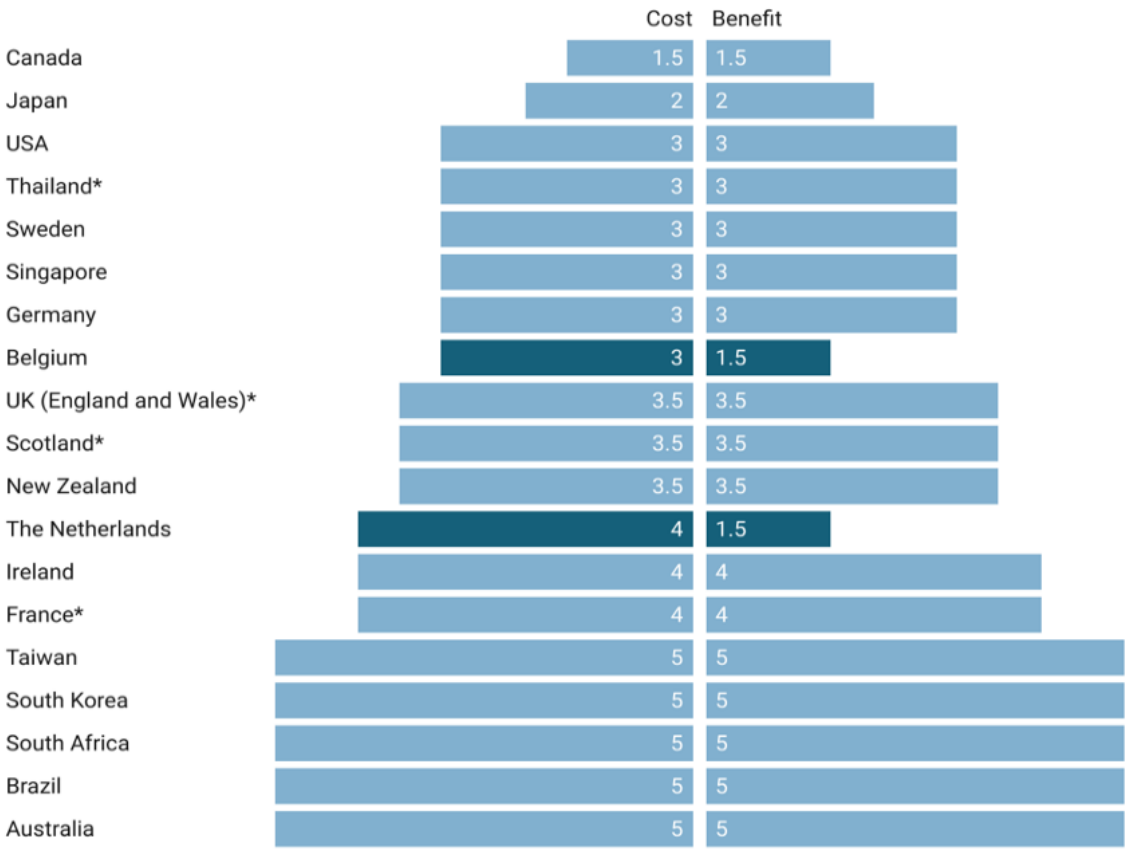
Supplementary presentation of a 1.5% non-reference discount rate is recommended for life-saving treatments likely to restore patients to full or near-full health, with benefits likely to be sustained over a very long period.

Source: Sharma et al. (2021), Khorasani et al. (2022)

As shown in Table 2, the majority of countries apply the same value for costs and benefits. Among the 19 countries included in this analysis, current discount rates for costs range from 1.5% to 5%, with 3% and 5% being the most common (5 of 19 and 5 of 19 (26%), respectively). Discount rates for health benefits also range from 1.5% to 5%, with 3% and 5% being the most common (5 of 19 and 5 of 19 (26%), respectively). Most of the countries listed in Table 2 have consistently applied equal discounting to costs and health benefits since 1990, with the exception of Belgium (which currently applies differential discounting) and France and the UK (both of which recommended differential discounting at some point in the past, but currently recommend equal discounting). Historically, time-variable rates were observed variously across the 30-year time frame of the analysis in France, Ireland and the UK, though constant discounting was dominant (16 of 19 countries, 84%).

A summary of these 19 countries' current rates and discounting models (i.e., equal, differential) is provided in Figure 1.

Figure 1. HTA discount rate by country, equal vs differential (2020, 2021)



Notes: *Denotes a lower rate may be used in prescribed circumstances. In England and Wales, NICE recommends a reference-case discount rate of 3.5% for costs and benefits. Supplementary presentation of a 1.5% non-reference discount rate is recommended for life-saving treatments likely to restore patients to full or near-full health, with benefits likely to be sustained over a very long period.

Source: ISPOR (2022)

As shown in Figure 1, of the 19 countries surveyed, reference-case differential discounting of costs and health benefits is currently only used in Belgium and the Netherlands. In both countries, HTA guidelines recommend the discounting of health benefits at a lower rate than costs, premised on the value of health increasing over time and policy support for preventive interventions (e.g., screening, vaccination) that generate benefits over the long term [5, 9, 40].

Of 31 current national health economic evaluation guidelines reviewed by Sharma et al. (2021) only three countries explicitly allow for time-variable discount rates, with reduced rates to be applied in prescribed circumstances: Thailand (time horizon of > 30 years: 4% costs, 2% health benefits) [40]; the UK (long-term benefits of at least 30 years: 3.5% costs, 1.5% health benefits) [41]; and France (time horizon > 30 years, no less than 2% costs and health benefits) [40]. HTA guidelines in Scotland specify a discount rate of 3.5% for costs and benefits for a time horizon of up to 30 years.

A snapshot of these countries HTA guidelines is provided in Table 3 (excluding Singapore, for which ISPOR did not provide guidelines). This summary is drawn from the website of the International Society for Pharmacoeconomics and Outcomes Research (ISPOR), the most reputed international database of pharmacoeconomic and health economic evaluation guidelines, representing some 110 counties. There is minimal evidence provided of the underlying rationale for countries' choice of a discount rate in the literature; the most common stated reasons include consistency with existing recommendations and central governments' cost of borrowing [9, 40, 41].

Table 3. Summary of HTA guidelines by country (2022)

	Discounting costs	Discounting outcomes
Australia	Base case: 5% per year. Sensitivity analyses: 3.5% and 0% (same rate applied to both costs and outcomes).	Base case: 5% per year. Sensitivity analyses: 3.5% and 0% (same rate applied to both costs and outcomes).
Belgium	Future costs should be discounted at a rate of 3%	Future benefits should be discounted atat a rate of 1.5%
Brazil	Base case: 5%	Base case: 5%
Canada	Yes, standard 1.5%; conduct sensitivity analyses using 0%, 3%	Yes, standard 1.5%; conduct sensitivity analyses using 0%, 3%
France	The reference case analysis uses the French social discount rate which has been set at 4% since 2005, for time horizons of less than 30 years with a reduction of up to 2% thereafter.	The reference case analysis uses the French social discount rate which has been set at 4% since 2005, for time horizons of less than 30 years with a reduction of up to 2% thereafter.
Germany	Base case 3%, sensitivity analyses at 0,5,7, and 10%.	Base case 3%, sensitivity analyses at 0,5,7, and 10%.
Ireland	4% (Univariate sensitivity analysis 0-10%, 3-5%)	4% (Univariate sensitivity analysis 0-10%, 3-5%)
Japan	2%	2%
New Zealand	3.5% , and between 0% and 5% in sensitivity analyses.	3.5% , and between 0% and 5% in sensitivity analyses.
Scotland	An annual discount rate of 3.5% should be used for analyses with a time horizon of less than 30 years. Sensitivity analysis should vary the rate between 0% and 6%.	An annual discount rate of 3.5% should be used for analyses with a time horizon of less than 30 years. Sensitivity analysis should vary the rate between 0% and 6%.
South Africa	Future costs should be discounted at an annual rate of 5% (range 0% to 10% for sensitivity analysis)	Future benefits should be discounted at an annual rate of 5% (range 0% to 10% for sensitivity analysis)
South Korea	5%	5%
Sweden	Base:3%; SA:0~5%; 3%	Base:3%; SA:0~5%; 0%
Taiwan	Base: 3%;	Three scenarios: discount cost but not outcome, both discounted, both not discounted
Thailand	Future costs should be discounted at a rate of 3%.	Future benefits should be discounted at a rate of 3%.
The Netherlands	4%	1.50%
UK (England & Wales)	Base: 3.5%; SA: 1.5%	Base: 3.5%; SA: 1.5%
USA	When appropriate, adjustment for the time preference should be incorporated and should follow US PHS Panel recommendations.	When appropriate, adjustment for the time preference should be incorporated and should follow US PHS Panel recommendations.

Notes: **Published pharmacoeconomic recommendations**: country-specific economic evaluation guidelines or recommendations published by experts in the field but not 'officially' recognized or required by the healthcare decision-making bodies in this country for reimbursement.

Pharmacoeconomic guidelines: country-specific 'official' guidelines or policies concerning economic evaluation that are recognized or required by the healthcare decision-making bodies in this country for reimbursement.

Submission guidelines: country-specific 'official' guidelines or policies concerning drug submission requirements with an economic evaluation component and are required by the healthcare decision-making bodies in this country for reimbursement.

In England and Wales, NICE recommends a reference-case discount rate of 3.5% for costs and benefits. Supplementary presentation of a 1.5% non-reference case discount rate is recommended for life-saving treatments likely to restore patients to full or near-full health, with benefits likely to be sustained over a very long period.

Source: ISPOR (2022)

5. Arguments for change

5.1. Medicines Australia

Within the framework of the Minister's review of discounting practices in HTA and health economic evaluation in Australia, Medicines Australia argues in its submission for a reduction of the PBAC's base-case discount rate to 1.5%. [1].

Key issues raised in Medicines Australia's submission include:

- Australia's base-case discount rate of 5% is higher than that of most similarly economically developed countries with advanced HTA systems
- Internationally, reference-case discount rates have trended downward over the past three decades. Downward adjustments of discount rates based on social opportunity cost may reflect governments' historically low cost of borrowing
- A relatively high discount rate may contribute to higher estimated incremental cost effectiveness ratios (ICERs) for some therapies, particularly those with high up-front costs and long-term health benefits. Medicines Australia posits that for a number of submissions, use of the 5% discount rate contributed to high ICERs, which may have been a contributing factor to the PBAC's decisions to not recommend submissions, delaying access to some therapies
- Evidence suggests that society's willingness-to-pay for health is increasing with income, which may justify a downward adjustment of the discount rate applied to health benefits (and implies adoption of differential accounting).

As Australia does not have a fixed ICER threshold, it is not possible to determine the extent to which use of the 5% discount rate impacted the PBAC's decision to not recommend submissions cited by Medicines Australia. While the discount rate does impact a therapy's estimated ICER, other contributing factors—including the strength of evidence presented, clinical effectiveness for the requested indication and price, among others—are taken into consideration by the PBAC in its recommendations.

In its submission, Medicines Australia states:

- "It is […] vital discount rates truly reflect how society values the present compared to the future." (p. 4)
- "Comparable high-income countries increasingly [value] the health outcomes of their future generations more, while Australia values its future health more akin to that of a lower-income developing nation." (p. 6)
- "Australia values the lives of its citizens less than comparable nations." (p. 6)

These points are not reflective of the reviewed academic literature on discounting, whose arguments do not focus on the question of whether discounting reflects a social preference for the health of one generation over that of another. Rather, discounting is characterised in the literature as a reflection of individuals' preference for healthcare consumption in the current period over that same level of consumption in the future. The focus of the literature is not *which generation's health is more highly valued*, but *how to maximise society's overall health outcomes when costs and benefits accrue over time*. As noted by Harrison [2]:

> "If too little is being done for the future, the answer is to increase overall savings and investment rates, not to use below market discount rates and invest in projects with low returns." (p. 21)

Medicines Australia also argues that the PBAC's current discount rate is inconsistent with Government's policy commitment to increase health investment in prevention (p. 4). However, Australia has a wide-ranging program of subsidised immunisation, through which vaccines assessed by the PBAC are provided. Preventive therapies are typically more sensitive to discounting than other forms of treatment (due to their higher up-front costs and longer-term benefits), but the findings of the reviewed literature indicate that adjustments to the discount rate are not generally considered an appropriate mechanism to promote distributional equity or particular health policy priorities [2, 5]. Further, explicit use of the discount rate to address these issues is not common in international practice [9]. As discussed, discounting is undertaken to reflect social time preferences for costs and benefits now relative to the future. Where therapies are deemed desirable—if not strictly cost-effective—decision-makers in Government may have other, more appropriate tools at their disposal to enable those therapies to be publicly subsidised, including controls on pricing and subsidy.

Within scope of the Minister's review is to discern whether the PBAC's base-case discount rate aligns with international 'best-practice' [43]. While the academic literature has not established a consensus regarding 'best-practice' in discounting, Medicines Australia considered the extent to which the following factors were identified as indicative of the degree of methodological and process robustness:

- Methodology and rationale for discount rate are specified.
- Processes are established for setting and review of the discount rate.
- A frequency is determined for setting and reviewing the discount rate.
- Rates reflect the state of:
    a. Underlying drivers (i.e., country-specific opportunity cost or time preference); and
    b. Methodological developments (as reflected in health economic literature).

Based on the evidence reviewed, these factors may be considered an appropriate initial set of criteria for determining the PBAC's base-case discount rate.

Medicines Australia concludes that countries with similarly advanced economies and comparable HTA systems—including the UK, Canada, France, and New Zealand—have reduced their discount rates over time, reflecting recent academic research, macro-economic conditions and the positive relationship between the social value of health and income. These observations were supported by the peer-reviewed and grey literature surveyed for this review.

With respect to observed lower discount rates internationally potentially reflecting governments' reduced costs of borrowing, it should be noted that tying the discount rate to a government's cost of debt implies that discounting reflects the social opportunity cost of investment (rather than social time preference) and the corollary that when capital market interest rates rise, so too should the discount rate. Insofar as interest rates fluctuate over time, pinning the discount rate to Government's cost of borrowing may exacerbate uncertainty in future costs to Government, as well as complicate the comparison of treatments' cost-effectiveness over time.

Medicines Australia also observes that in some cases, HTA systems have incorporated differential discounting, with a lower rate applied to health benefits in recognition of the increasing value placed

on health by society. While examples exist (e.g., the Netherlands), differential discounting on this basis represents an outlier practice, with the majority of countries surveyed recommending the use of equal discounting [9].

5.2. Stakeholder submissions

As part of its review of the discount rate, the Department is undertaking a two-phase consultation approach to capture the perspectives of stakeholders likely to be impacted by a change in the PBAC's base-case discount rate (Phase 1) and provide feedback to the independent analysis contained in this report (Phase 2).

Phase 1 consultation was open from 5 – 29 April 2022. Stakeholders were invited to answer the following questions:

- How does the discounting method in section 3A.1 of the PBAC guidelines compare with discounting methods used in economic evaluations that support other public funding decisions in Australia and in comparable overseas jurisdictions?
- Does the base case discount rate outlined in section 3A.1 of the PBAC guidelines need to be changed? If so, what should it be and why?

Topics considered out-of-scope included:

- the Health Technology Assessment Policy and Methods Review
- review or change of previous PBAC recommendations

The Department received 21 stakeholder submissions to the Phase 1 consultation, including 19 respondents from the pharmaceutical sector, an academic institution, and a consumer advocacy organisation. All submissions were de-identified for analysis prior to receipt by CHERE and are disclosed by the Department (Appendix 3) where consent has been provided by the submitters. Emergent issues presented in the stakeholder submissions to the Review are summarised in Table 4.

Table 4. Summary of thematic issues raised in stakeholder submissions to the Review

Issue raised by stakeholder	*Annotations*
The PBAC's base-case discount rate should be reduced to 1.5% for costs and benefits.	This position, put forward by Medicines Australia on behalf of the innovator medicines industry, was explicitly supported by 20 of 21 respondents from whom submissions were received. (Section 5.1) All respondents supported a reduction in the discount rate.
Discounting disadvantages therapies with relatively high up-front costs and long-term benefits, including emerging biological therapies, vaccines and preventive therapies, life-saving therapies and therapies for childhood diseases.	The choice of discount rate may have a substantial impact on the estimated cost-effectiveness of a health intervention, especially when the benefits of an intervention accrue over a long period of time.
The PBAC's base-case discount rate of 5% is higher than the rates used in most similarly economically developed countries with established HTA practice. Over the past three decades, international HTA discount rates have trended downward.	This observation is supported by the available data (Section 4.2). The PBAC's base-case discount rate is, however, lower than the discount rate of 7% commonly used in the evaluation of public investment in non-HTA settings in Australia.
Discounting at the PBAC's base-case rate of 5% may have contributed to delays in access to therapies in Australia.	See Section 5.1 for elaboration.
Discounting at the PBAC's base-case rate of 5% may disincentivise development of emerging biological therapies and medicines for rare-diseases.	See Section 5.1 for elaboration.

Issue raised by stakeholder	*Annotations*
The PBAC should consider the use of differential discounting.	There is theoretical support for differential discounting in the literature, though it is rarely used in practice internationally. (Section 3.2)
The PBAC should consider the use of time-variable discounting.	There is evidence of hyperbolic (i.e., time-variable) discounting in the literature, though it is rarely used in practice internationally. (Section 3.2)
The PBAC should consider the use of a non-base case rate of 1.5% for curative therapies.	NICE (UK) recommends use of a non-reference case discount rate of 1.5% for curative therapies. (Section 4.2)
The PBAC's base-case rate should be benchmarked against rates used in health economic analysis in similarly economically developed countries with established HTA practices	International comparison may provide an appropriate basis for understanding social time preference and the choice of discount rate level in comparable contexts. (Section 5.3)
There is support in the research literature and policy sphere for reducing the discount rate in use by most Australian government agencies since the 1980s from 7% to 3.5%-4%. Cited examples note that the risk-free rate has fallen considerably since the 7% rate was established.	Reference to the 'risk-free' interest rate implies that the PBAC discount rate is (or should be) linked to Government's cost of borrowing, i.e., a social opportunity cost model. (Section 3.1)
The discount rate used in health economic evaluation should not be benchmarked against discount rates used by other Government agencies to assess public infrastructure expenditure; Discounting in HTA should not be used to account for 'project-risk.'	There is evidence in the research literature that individuals' time preference for health consumption may not be reflected in governments' cost of borrowing. (Section 3.1); The literature suggests that the discount rate is generally not an appropriate mechanism to account for project-specific risk. (Section 3.3)
The utility associated with additional years of life does not decline as real incomes rise.	The literature suggests that the marginal utility of health consumption decreases with income due to individuals' time preference (Section 3.2) but may also increase as social expectations of health change. (Section 3.3) The net effect of these counterinfluences is not clear.
The PBAC's base-rate discount rate of 5% is at odds with Government health policy commitments to invest in preventive therapies.	The literature suggests that adjusting the discount rate may not be an economically efficient means to impact equity and other health policy objectives, and that Government's use of the tax and transfer systems may be more suited to these ends (Section 5.1)
Changing the PBAC's base-case discount rate is likely to have significant knock-on policy and distributional impacts, including in decision-making by the Medical Services Advisory Committee (MSAC).	See Section 5.3 for elaboration.
A reduction in the discount rate implies a lower opportunity cost of displaced healthcare interventions and should entail a corresponding reduction in the PBAC's implicit cost-effectiveness threshold.	If the discount rate and effective willingness-to-pay threshold are reduced, then the proportion of treatments yielding benefits further into the future is likely to increase, displacing healthcare interventions whose benefits accrue over shorter time horizons [44].
The PBAC and MSAC are interdependent and their respective discount rates should be aligned.	Respondent noted that in some cases, nomination of the assessment body (PBAC vs MSAC) is solely a function of the funding regime through which a therapy is proposed to be made available.
Whilst alternative discount rates may be presented in sensitivity analyses, the PBAC does not apparently or sufficiently take alternative rates into account in cost-effectiveness determinations.	Uncertainty of future cost and health outcome values should be addressed through direct appraisal of these flows and via sensitivity analysis. (Section 3.3)
The PBAC's base-case discount rate of 5% has contributed to an impression among international pharmaceutical industry stakeholders that Australia is "a challenging market with uncertain approval processes," and may lead to feelings of	The literature suggests that adjusting the discount rate may not be an economically efficient means to impact equity and other health policy objectives, and that Government's use of the tax and transfer systems may be more suited to these ends (Section 5.1)

Issue raised by stakeholder	*Annotations*
despair among patients for whom relevant medicines are only available abroad.	
There may be a misalignment of the PBAC's risk preferences with respect to societal risk preferences, reflected in the PBAC's base-case discount rate and 'conservative' ICER threshold.	Respondent bases this on the following: the Department of the Prime Minister and Cabinet's estimated value of a statistical life year is AU $217k [45]; assuming a utility of 0.75 would imply a willingness-to-pay of approximately AU $160k per QALY, relative to the respondent's assumed PBAC threshold of approximately AU $80k per QALY. It should be noted that the PBAC does not have an explicit willingness-to-pay threshold.

5.3. Evaluating arguments for change

As demonstrated in Section 4.2, the PBAC's base-case discount rate of 5% for health benefits and costs is higher than many other countries with comparable levels of economic development and similarly advanced HTA systems, including: France (4%), Ireland (4%), New Zealand (3.5%), Scotland (3.5%), UK (3.5%), Germany (3%), Singapore (3%), Sweden (3%), US (3%), Japan (2%), Belgium (1.5% benefits, 3% costs), Canada (1.5%), and The Netherlands (1.5%, 4%). Among economically developed countries with established HTA practice, only South Korea and Australia currently use a discount rate of 5% for costs and health outcomes [42].

The PBAC's long-established discount rate has served as a basis for consistent assessment of submissions for the inclusion of new therapies on the PBS. In its Background Document on the use of economic analysis in HTA, the (former) Department of Health, Housing, Local Government and Community Services acknowledged "a dispute whether the opportunity cost of capital or the rate of time preference should be used as the discount rate in an economic analysis," and a range for the discount rate "believed to lie somewhere between about 3% and 8% in Australia" (p. 43) [36]. The authors deemed the 5% discount rate then recommended by the New England Journal of Medicine as "reasonable" for application in Australia (p. 43). However, a theoretical rationale underpinning the application of this rate does not appear to have been made explicit.

Establishing a clear theoretical basis for the choice of discount rate in HTA provides an opportunity to enhance equity and transparency in decision-making, and help ensure that Australian health policy reflects the state of the art in HTA and cost-effectiveness evaluation. Discounting in health economic evaluation may be made more robust by specifying:

- a theoretical rationale for discounting costs and health benefits, informed by identified drivers of social time preference in Australia;
- a methodology for estimating the discount rate based on underlying parameters; and
- the process and timing of periodic reviews.

Claims of higher opportunity costs of public investment in low and middle income countries are not borne out empirically in the realised returns to private capital in these settings and may therefore be overstated [2]. Nonetheless, if the PBAC base-case rate is to be based on an estimate of the STPR in Australia (i.e., on pure time preference, systemic and catastrophic risk, economic growth and the marginal utility of healthcare consumption), then international comparison for the purpose of

benchmarking should emphasise an appropriate comparator group where these factors are likely to be similar (i.e., high-income countries with similarly advanced HTA systems).

As noted in a stakeholder submission (see Section 5.2), O'Mahoney et al. suggest that a reduction in the discount rate implies a lower opportunity cost of displaced healthcare interventions and may therefore entail a corresponding reduction of the implicit cost-effectiveness threshold. If the discount rate and effective willingness-to-pay threshold are reduced, the authors hypothesise, then the proportion of treatments yielding benefits further into the future is likely to increase, displacing healthcare interventions whose benefits accrue over shorter time horizons [44].

Changing the PBAC's base-case discount rate is likely to have significant financial implications and associated knock-on effects throughout the health system. As noted by NICE in its determination to maintain its reference-case discount rate at 3.5% for costs and health outcomes [38],

> "One of the most visible system implications of a change in discount rate for NICE health technology evaluations is the financial impact. Reducing the discount rate will make most technologies appear to be more cost effective. In the absence of a change in the level at which technologies are considered cost effective, this would likely lead to higher prices for those health technologies, with knock-on effects on care and services elsewhere […]." (p. 38)

Further, the PBAC's base-case discount rate of 5% is already lower than the discount rate used in the appraisal of infrastructure and other forms of public investment in Australia. Lowering the HTA discount rate without a commensurate decrease in the rate used elsewhere would exacerbate this difference, with the implication that health is considered more important than other areas of Government spending (e.g., food safety, infrastructure).

Finally, a health intervention deemed not to be cost-effective at a particular willingness-to-pay threshold may still be considered worthwhile of public subsidy from a social and political point of view. Rather than attempt to reconcile projects' estimated cost-effectiveness through adjustments to the discount rate, Government may more ably support its preferred health strategies through other mechanisms at its disposal (e.g., pricing, subsidy) [2].

6. Conclusion

Discounting is a tool to improve economic efficiency in decision-making; no matter how the discount rate is derived, it cannot say what a society's preferred outcomes and investment priorities should be from an ethical perspective. As an approach to evaluating the differential timing of resource use and outcomes, discounting is well-established in the academic literature and is common practice internationally. There is not, however, academic or professional consensus concerning the theoretically or practically preferred choice of the discount rate in health economic evaluation, nor whether differential or time-variable rates should be applied. All else equal, discounting future costs and health benefits will have a higher impact on the estimated cost-effectiveness of therapies with relatively high up-front costs and long-term realisation of health benefits.

While adjusting the discount rate may not be an economically efficient method to support particular health policy preferences, there may nonetheless be a case for reducing the PBAC's base-case discount rate in line with economic theory and international practice. However, any change to the PBAC's base-case discount rate, including the application of differential or time-variable rates, should be informed by an empirical analysis of the estimated cost to Government, price impacts, cost-

effectiveness thresholds, approval and displacement of therapies, and a range of knock-on policy impacts likely to result across the health sector—including MSAC decision-making—and other areas of public investment. Since a lower discount rate increases the chance that an intervention will be deemed cost-effective at a given requested price—and hence more amenable to public subsidy—any proposed change must consider the implications for total investment in healthcare via the PBS relative to other sectors of public investment. Moreover, changing the discount rate must also be weighed against discounting's underlying purpose, which is to facilitate the comparison of health interventions over time.

Appendix 1. Literature review

Scope—Publications reviewed included both peer-reviewed and grey literature (e.g., Government reviews, reports, guidelines) published in September 2018 or later. Eligible publications were identified through an online search of the MEDLINE (PubMed) database in May 2022. Reports of clinical trials and trial protocols were excluded.

Search terms—[Title/Abstract] (Health technology assessment, Economic evaluation, Cost-effectiveness, Cost-benefit, Cost-utility, Economic analysis) AND (Discount, Discount Rate) NOT (Clinical trials, Clinical studies).

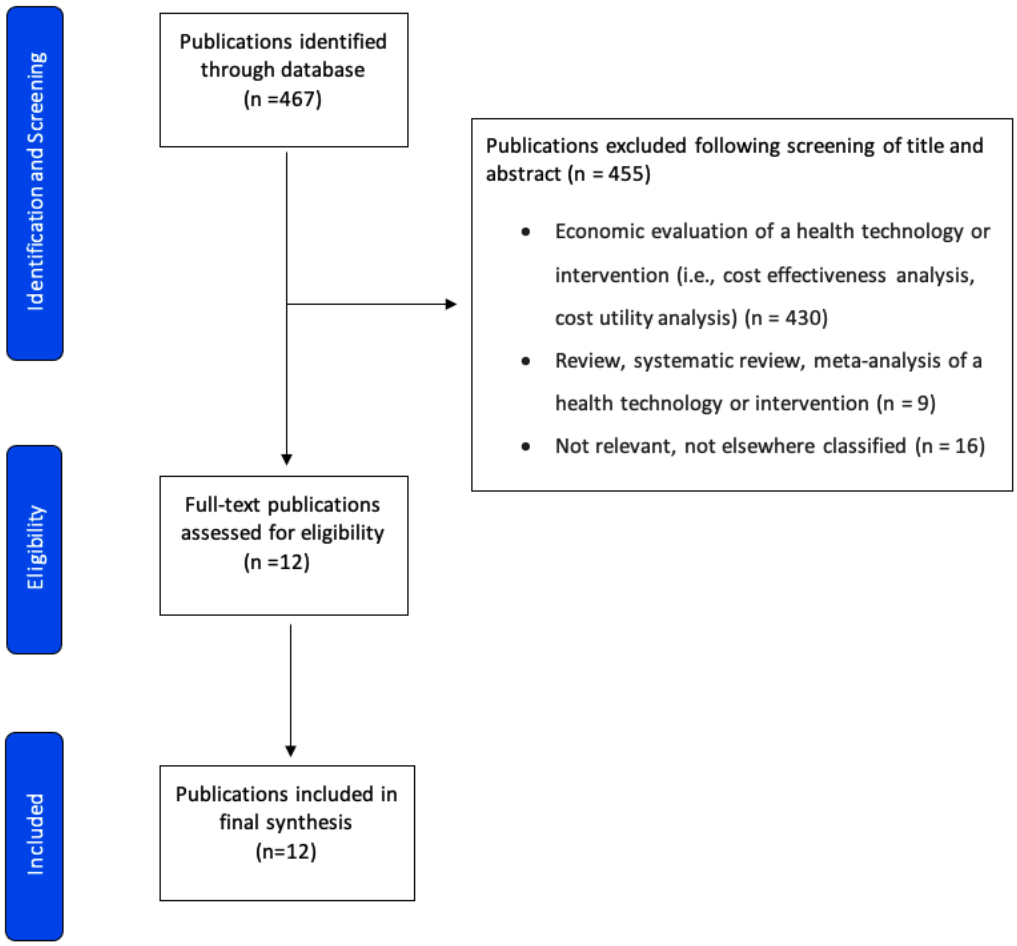
Exclusion criteria—The titles and abstracts of identified publications were screened, with publications excluded on the following criteria:

- Economic evaluation of a health technology or intervention (i.e., cost effectiveness analysis, cost utility analysis)
- Review, systematic review, meta-analysis of a health technology or intervention
- Clinical trial, study protocol
- Not relevant, not elsewhere classified

Results—The literature search produced total of 467 publications. After screening, 12 publications were included in the final synthesis, including a comprehensive historical review of international HTA discounting practices through September 2018 [9].

A Preferred Reporting of Items in Systematic Reviews and Meta-analyses (PRISMA) flowchart of the literature search is provided in Figure 2.

Figure 2. PRISMA flowchart



Appendix 2. About CHERE

CHERE is an internationally recognised centre of excellence in health economics and health services research with a reputation for high-quality methodological and applied research, and for the delivery of timely research relevant to policymakers at all levels of the health system. For more than 30 years, CHERE's experienced researchers have provided expertise in health technology assessment, health economics analysis, and the design and analysis of choice experiments. CHERE is a long-time evaluator of submissions to the PBAC and MSAC.

Appendix 3. Submissions to the Review

The Department received submissions to the Phase 1 consultation from the following stakeholders:

- AbbVie Pty Ltd
- Amgen Australia Pty Limited
- AstraZeneca Pty Ltd
- Biogen Australia Pty Ltd
- BioMarin Pharmaceutical Australia Pty Ltd
- Bristol Myers Squibb Australia Pty Ltd
- CSL Behring
- Glaxosmithkline Australia Pty Ltd
- Janssen-Cilag Pty Ltd
- Macquarie University
- Medicines Australia
- Novo Nordisk Pharmaceuticals Pty Ltd
- Pfizer Australia Pty Ltd
- Rare Voices Australia
- Sanofi-aventis Australia Pty Ltd
- Shawview Consulting
- Vertex Pharmaceuticals (Australia) Pty Ltd
- Vifor Pharma Pty Ltd

References

[1] Medicines Australia. (2022). Submission to the PBAC on the base case discount rate. Deakin: Medicines Australia.

[2] Harrison, M. (2010). Valuing the future: The social discount rate in cost-benefit analysis. Canberra: Productivity Commission.

[3] Samuelson, P. A. A note on measurement of utility. *The review of economic studies, 4*(2), 155-161. (1937)

[4] Ramsey, F. P. A mathematical theory of saving. *The economic journal, 38*(152), 543-559. (1928)

[5] Attema, A. E., Brouwer, W. B., & Claxton, K. Discounting in economic evaluations. *Pharmacoeconomics, 36*(7), 745-758. (2018)

[6] Frederick, S., Loewenstein, G., & O'donoghue, T. Time discounting and time preference: A critical review. *Journal of economic literature, 40*(2), 351-401. (2002)

[7] UK Government. (2022). The Green Book. Central Government guidance on appraisal and evaluation. London: HM Treasury.

[8] Sanders, G. D., Neumann, P. J., Basu, A., et al. Recommendations for conduct, methodological practices, and reporting of cost-effectiveness analyses: second panel on cost-effectiveness in health and medicine. *Jama, 316*(10), 1093-1103. (2016)

[9] Khorasani, E., Davari, M., Kebriaeezadeh, A., Fatemi, F., Akbari Sari, A., & Varahrami, V. A comprehensive review of official discount rates in guidelines of health economic evaluations over time: the trends and roots. *The European Journal of Health Economics*, 1-14. (2022)

[10] National Institute for Health and Care Excellence (NICE). (2020). The NICE methods of health technology evaluation: the case for change. London: NICE.

[11] Drupp, M. A., Freeman, M. C., Groom, B., & Nesje, F. Discounting disentangled. *American Economic Journal: Economic Policy, 10*(4), 109-134. (2018)

[12] Brouwer, W. B., Niessen, L. W., Postma, M. J., & Rutten, F. F. Need for differential discounting of costs and health effects in cost effectiveness analyses. *Bmj, 331*(7514), 446-448. (2005)

[13] Gravelle, H., & Smith, D. Discounting for health effects in cost–benefit and cost-effectiveness analysis. *Health Economics, 10*(7), 587-599. (2001)

[14] Klock, R. M., Brouwer, W. B., Annemans, L. J., Bos, J. M., & Postma, M. J. Towards a healthier discount procedure. *Expert Review of Pharmacoeconomics & Outcomes Research, 5*(1), 59-63. (2005)

[15] Keeler, E. B., & Cretin, S. Discounting of life-saving and other nonmonetary effects. *Management science, 29*(3), 300-306. (1983)

[16] Weinstein, M. C., & Stason, W. B. Foundations of cost-effectiveness analysis for health and medical practices. *New England Journal of Medicine, 296*(13), 716-721. (1977)

[17] van der Pol, M., & Cairns, J. A comparison of the discounted utility model and hyperbolic discounting models in the case of social and private intertemporal preferences for health. *Journal of Economic Behavior & Organization, 49*(1), 79-96. (2002)

[18] Scharff, R. L. Obesity and hyperbolic discounting: Evidence and implications. *Journal of Consumer Policy, 32*(1), 3-21. (2009)

[19] Strulik, H., & Trimborn, T. Hyperbolic discounting can be good for your health. *Journal of Economic Psychology, 69*, 44-57. (2018)

[20] Braithwaite, R. S., & Roberts, M. S. Are Discount Rates Too High? Population Health and Intergenerational Equity. *Medical Decision Making, 41*(2), 245-249. (2021)

[21] Australian Government. (2020). Cost-benefit analysis. Guidance note. Canberra: Department of the Prime Minister and Cabinet, Office of Best Practice Regulation.

[22] US Environmental Protection Agency. (2010). Guidelines for preparing economic analyses. Washington, DC: US Environmental Protection Agency.

[23] Arrow, K., Cline, W., Maler, K.-G., Munasinghe, L., Squitieri, R., & Stiglitz, J. (1996). Intertemporal equity, discounting, and economic efficiency *Intergovernmental Panel on Climate Change*

(IPCC), Climate Change 1995, Economic and Social Dimensions of Climate Change (pp. 125-144). Cambridge: Cambridge University Press.
[24] Hultkrantz, L. Discounting in economic evaluation of healthcare interventions: what about the risk term? *The European Journal of Health Economics, 22*(3), 357-363. (2021)
[25] Australian Government. (2016). Guidelines for preparing a submission to the Pharmaceutical Benefits Advisory Committee. Version 5.0. Canberra: Australian Government, Department of Health.
[26] MacKeigan, L. D., Gafni, A., & O'Brien, B. J. Double discounting of QALYs. *Health Economics, 12*(2), 165-169. (2003)
[27] Drummond, M., O'Brien, B., Stoddart, G., & Torrance, G. (1997) *In Methods for the economic evaluation of health care programmes* (pp. 184–185). Oxford: Oxford Medical Publications.
[28] Claxton, K., Paulden, M., Gravelle, H., Brouwer, W., & Culyer, A. J. Discounting and decision making in the economic evaluation of health-care technologies. *Health Economics, 20*(1), 2-15. (2011)
[29] Hone, S., Gooday, P., Hafi, A., & Greenville, J. (2022). Discount rates and risk in the economic analysis of agricultural projects. ABARES Working Paper 22.02. Canberra: Australian Government, Department of Agriculture, Water and the Environment.
[30] Terrill, M., & Batrouney, H. (2018). Unfreezing discount rates: transport infrastructure for tomorrow. Carlton: Grattan Institute.
[31] Parliament of Australia. (2018). Building up and moving out. Canberra: Parliament of Australia, House of Representatives Standing Committee on Infrastructure, Transport and Cities.
[32] Abelson, P., & Dalton, T. Choosing the Social Discount Rate for Australia. *Australian Economic Review, 51*(1), 52-67. (2018)
[33] Government of New South Wales. (2017). NSW Government guide to cost-benefit analysis. Sydney: Government of New South Wales, Treasury.
[34] Government of Victoria. (2013). Economic evaluation for business cases, Technical guidelines. Melbourne: Victorian Government, Department of Treasury and Finance.
[35] Pharmaceutical Benefits Advisory Committee (PBAC). (2016). Guidelines for preparing a submission to the Pharmaceutical Benefits Advisory Committee. Canberra: Australian Government, Department of Health.
[36] Evans, D., Freund, D., Dittus, R., Robertson, J., & Henry, D. (1993). Background document on the use of economic analysis as a basis for inclusion of pharmaceutical products on the Pharmaceutical Benefits Scheme. Canberra: Australian Government, Department of Health, Housing, Local Government and Community Services.
[37] National Institute for Health and Care Excellence (NICE). (2022). NICE health technology evaluations: the manual. London: NICE.
[38] National Institute for Health and Care Excellence (NICE). (2022). Review of methods, processes and topic selection for health technology evaluation. London: NICE.
[39] Haacker, M., Hallett, T. B., & Atun, R. On discount rates for economic evaluations in global health. *Health Policy and Planning, 35*(1), 107-114. (2020)
[40] Sharma, D., Aggarwal, A. K., Downey, L. E., & Prinja, S. National Healthcare Economic Evaluation Guidelines: A Cross-Country Comparison. *Pharmacoecon Open, 5*(3), 349-364. (2021)
[41] Devlin, N., & Scuffham, P. Health today versus health tomorrow: does Australia really care less about its future health than other countries do? *Aust Health Rev, 44*(3), 337-339. (2020)
[42] International Society for Pharmacoeconomics and Outcomes Research (ISPOR). (2022). Pharmacoeconomic guidelines around the world. Lawrenceville: ISPOR.
[43] Australian Government. (2022). Review of the discount rate in the PBAC guidelines. Canberra: Australian Government, Department of Health.
[44] O'Mahony, J. F., Paulden, M., & McCabe, C. NICE's Discounting Review: Clear Thinking on Rational Revision Meets Obstacle of Industrial Interests. *Pharmacoeconomics, 39*(2), 139-146. (2021)

[45] Australian Government. (2020). Best practice regulation guidance note. Value of a statistical life. Canberra: Australian Government, Department of the Prime Minister and Cabinet.