Pre-read document
Accounting for the timing of costs and benefits in the evaluation of health projects relevant to LMICs

Thursday 14th September 2017, 8:30 - 17:15

Harvard Club of Boston, 374 Commonwealth Avenue, Boston MA 02115

Many thanks for agreeing to participate in what we hope will be a productive and enjoyable workshop. It is an ambitious day of four core session, broken down into eight topics. Speakers will introduce each topic with a short presentation (15mins) clarifying conceptual matters before addressing what would constitute relevant evidence to inform the key quantities, what evidence is currently available and how a decision maker might make a reasonable assessment relevant to LMIC contexts. The role of discussant for each session is to initiate a focused group discussion by briefly responding to any issues in the presentation and raising other issues that ought to be discussed. We intend that group discussion will dominate the content of all sessions. Note takers will be recording the salient features of the discussion so that we can provide a summary for participants to comment on after the workshop. An important output of the workshop will be to express concepts and principles in a way that research users, including policy and decision makers in LMICs and supra national bodies, can appreciate and be empowered to judge appropriate discount policies relevant to different contexts.

Contents

Appendix A and B are attached separately with relevant sections and pages referenced in the footnotes of the main document. These two chapters provide a bit more accessible detail on the rationale and practice of economic evaluation of health care programmes using cost-effectiveness analysis which may be less familiar to some attendees.

Agenda

08:30 – 08:50 Registration and coffee

08:50 – 9:00 Welcome and introductions

[Chair: David Wilson]

09:00 - 09:50 Context, normative positions and the key quantities required

[15 minute presentation: Karl Claxton]

[5 minute introduction to discussion: Hilary Greaves]

[30 minute discussion]

09:50 – 11:45 Improving health outcomes

[1 minute, relationship of topics to 09:00-09:50 session: Karl Claxton]

09:50 – 10:40 Marginal productivity of health care expenditure and its evolution over time

[15 minute presentation: Jessica Ochalek]

[5 minute introduction to discussion: Pieter van Baal]

[30 minute discussion]

10:40 – 11:30 Opportunity costs of financing health care (and other public) expenditure

[15 minute presentation: Mike Paulden]

[5 minute introduction to discussion: Michael Spackman]

[30 minute discussion]

11:30 – 11:45 Mid-morning break

11:45 – 14:00 Improving social welfare

[1 minute, relationship of topics to 09:00-09:50 session: Karl Claxton]

11:45- 12:30 Social time preference for consumption

[15 minute presentation: Christian Gollier]

[5 minute introduction to discussion: Ben Groom]

[25 minute discussion]

12:30 – 13:15 Lunch

13:15 – 14:00 Consumption value of health and its evolution over time

[15 minute presentation: Jim Hammitt]

[5 minute introduction to discussion: Stephen Resch]

[25 minute discussion]

14:00 – 16:50 Uncertainty, risk and aggregation

[1 minute, relationship of topics to 09:00-09:50 session: Karl Claxton]

14:00 – 14:50 Uncertainty in the elements of social time preference and declining rates

[15 minute presentation: Ben Groom]

[5 minute introduction to discussion: Billy Pizer]

[30 minute discussion]

14:50 – 3:00 Mid-afternoon break

15:00 – 16:00 Project specific risks, catastrophic risks and the use of risk premiums

[15 minute presentation: Mark Freeman]

[5 minute introduction to discussion: Tom Sterner]

[40 minute discussion]

16:00 – 16:50 Aggregating effects across different heterogeneous contexts

[15 minute presentation: James Lomas]

[5 minute introduction to discussion: Maureen Cropper]

[30 minute discussion]

16:50 – 17:15 Wrap up and next steps

[5 minute initial summary: Karl Claxton]

[20 minute discussion]

19:00 Dinner

Abe & Louie's, 793 Boylston Street, Boston, MA 02116

Attendees

Miqdad Asaria	Indian Ministry of Health/International Development Support Initiative (iDSI)
Pieter van Baal	Institute of Health Policy & Management, Erasmus University
David Bloom	Department of Global Health & Population, Harvard T.H. Chan School of Public Health
Collins Chansa	World Bank, Zambia
Camilo Cid Pedraza	Pan-American Health Organization
Karl Claxton	Centre for Health Economics, University of York
Joshua Cohen	Tufts Medical Center
Maureen Cropper	Department of Economics, University of Maryland
David de Ferranti	Results for Development Institute
Anil Deolalikar	School of Public Policy, University of California, Riverside
Mark Freeman	York Management School, University of York
Christian Gollier	Toulouse School of Economics
Hilary Greaves	Faculty of Philosophy, University of Oxford
Ben Groom	London School of Economics
Frederico Guanais	Inter-American Development Bank
Brittany Hagedorn	Institute for Disease Modeling
James K. Hammitt	Harvard T.H. Chan School of Public Health
Dean Jamison	University of California – San Francisco
Julian Jamison	World Bank
Mark Jit	London School of Hygiene and Tropical Medicine
Paul Kelleher	School of Medicine & Public Health, University of Wisconsin-Madison
Murray Krahn (TBC)	University of Toronto
Jeremy Lauer	World Health Organization
James Lomas	Centre for Health Economics, University of York

Peter Neumann	Tufts Medical Center
Lucy O'Keeffe	Harvard T.H. Chan School of Public Health
Jessica Ochalek	Centre for Health Economics, University of York
Mead Over	Center for Global Development
Mike Paulden	School of Public Health, University of Alberta
Maria Petro-Brunal	The Global Fund
Billy Pizer	Nicholas School of the Environment, Duke University/Sanford School of Public Policy
Stephen Resch	Center for Health Decision Science, Harvard University
Lisa A. Robinson	Harvard T.H. Chan School of Public Health
Alexandra Rollinger	Centre for Health Economics, University of York
JP Sevilla	Department of Global Health & Population, Harvard T.H. Chan School of Public Health
Michael Spackman	NERA Economic Consulting
Thomas Sterner	School of Business, Economics & Law, University of Gothenburg
Gernot Wagner	Harvard School of Engineering & Applied Sciences
David Wilson	Bill and Melinda Gates Foundation
David Wilson	World Bank/HIV Modelling Consortium

Context, normative positions and the key quantities required

Karl Claxton, 1st September 2017

Summary

The history of changing and sometimes conflicting recommendations about discounting policies, especially for health projects, arise from alternative normative positions taken and different judgements about the empirical questions that follow.

Given the importance of being able to explicitly quantify other impacts beyond measures of health and public health expenditure, it may be appropriate to convert all effects into time streams of the equivalent consumption gains and losses, while reflecting the opportunity costs of existing constraints. These can be discounted at social time preference for consumption (STP), including any decline to reflect the impact of uncertainty in the elements of the Ramsey Rule.

This approach avoids embedding multiple augments in the discount rate for health and health care costs. The separate and explicit accounting for these arguments allows clarity about the quantities that need to be assessed, available evidence to be identified and used transparently and consistently, while preserving the possibility of accountable deliberation about evidence, values and unquantified arguments in decision making processes.

In addition to the elements of the Ramsey Rule used to estimate STP, this also requires the following quantities specific to health to be assessed: i) the marginal productivity of health care expenditure in producing health (and other effects) and its evolution over time; ii) the opportunity costs of financing health care (and other) public expenditure; and ii) the consumption value of health and its evolution over time.

1 Informing policy choices

A decision to introduce a policy (e.g., public health, educational, environmental etc.) or provide an effective intervention (e.g., a health technology or programme of care for a particular indication) for the current population may offer some immediate health benefits but, in many circumstances, the health benefits will occur in future periods. For example, the life-years gained from an intervention that reduces mortality will occur in future periods, even if the reduction in mortality is restricted to the current period. Other interventions are intended to reduce the risk of future events for the current population and others may also reduce risks for future incident patients (e.g. changing the dynamic effects of communicable and infectious diseases), so the health benefits they offer will not be fully realized for many years. Future benefits are not restricted to health but may also include impacts on private consumption opportunities, other forms of public expenditure and social objectives of particular interest to the decision maker (e.g., equity, financial protection etc.). Similarly, different policy choices and health interventions will not just impose health care and other costs in the current period but in future periods as well.

The question is how account should be taken of when heath care and other costs are incurred and health and other benefits are received. The intention is to offer accessible and practical clarity about

principles, the key assessment required and the evidence currently available to inform them, so that decision makers in LMICs, as well as global bodies and other stakeholders, are better placed to judge what would be an appropriate discount policy in a particular context. The primary focus of this workshop is to offer practical guidance on appropriate discounting of the costs and benefits of an intervention used in a particular context, where key quantities are likely to differ; setting out what type of evidence would be relevant, what is currently known that is relevant to low and middle income settings and how this evidence might be strengthened. This includes how global bodies, which make recommendations (e.g., WHO), purchase health technologies (e.g., Global Fund) or prioritise the development of new ones (e.g., BMGF), should judge the value of an intervention used in many different settings where appropriate discounting of costs and benefits are likely to differ. The BCA reference case will consider how to achieve comparability between the evaluation of policies and interventions relevant to very different contexts while also encouraging bespoke discounting policy more relevant to specific contexts.

1.1 Discounting health and health care costs for policy choice

The appropriate discounting of health effects and health care costs for social choices about health projects, programmes and technologies has been a source of debate and confusion over a number of years (e.g., Brouwer 2005, Claxton et al 2011, Nord 2011 and Paulden et al 2017). This is illustrated by the recent history of discounting policies by decision making bodies in high income countries. For example, the UK's National Institute for Health and Clinical Excellence (NICE), which issues guidance to the NHS, initially required that costs and health effects be discounted at a real rate of 6% and 1.5% respectively. This guidance was subsequently amended to rates of 3.5% for costs and 1.5% for health effects based on the reasoning in Gravelle and Smith, 2001. In 2004 NICE amended its guidance again, requiring costs and health effects to be discounted at the 3.5% STP specified by UK Treasury. This guidance was subsequently amended indicating that a lower common rate of 1.5% could also be considered when there are long term and substantial health benefits, which are 'highly likely' to be achieved, and where introduction of the technology does not commit the NHS to significant irrecoverable costs. A common discount rate for health and health care costs of 3% continues to be recommended in the US[1]. Exceptions to common discounting include the Belgian and Dutch Health Insurance Boards.[2]

In view of changing and sometimes conflicting recommendations made by decision making bodies it would not be surprising if practitioners, policy makers and other stakeholders (importantly clinical communities) are confused about why health should be discounted, whether health care costs should be discounted at the same rate as health and what discount rates should be applied.

Many of these conflicts and contradictions are more apparent than real and arise from different judgements about appropriate normative positions and empirical questions that follow:

[1] For example, the Washington Panel (Lipscomb et al. 1996) recommended common discounting at a rate of 3% . The recent update to this guidance (Neumann et al 2016) continues to recommend common discounting at 3% although the reasoning has been shown to be fatally floored (Paulden et al 2017).

[2] Examples, include the Belgian Federaal Kenniscentrum voor de Gezondheidszorg (KCE) guidelines for economic evaluation of pharmaceutical products require a discount rate of 3.5% for costs and 1.5% for health benefits (Cleemput et al., 2008, p. 28) and the Dutch Health Insurance Board require a discount rate of 4% for costs and 1.5% for health benefits (CVZ, 2006, p. 10).

i. Whether the social objective of the health care expenditure and the decision makers economic analysis claims to inform is to maximise welfare or health and other explicit social objectives
ii. Health and other opportunity costs associated with constraints on the growth in health care expenditure and how these are likely to evolve over time
iii. Opportunity costs of financing health care (and other) public expenditure
iv. Social time preference for consumption.
v. Consumption value of health and its evolution over time
vi. Uncertainty in the elements of STP and implications for declining rates
vii. How best to reflect project specific and catastrophic risks
viii. How best to aggregate effects across different contexts where these quantities differ

Lack of clarity has tended to be compounded when discounting is used to implicitly account for other considerations (e.g., expected changes in health opportunity costs and the consumption value of health over time) rather than representing effects as either a time stream of health gained and health forgone (discounted at an appropriate rate for health) or valuing this time stream of health gains and losses at their equivalent consumption value (discounted at a rate for consumption).

2 The objective of health care expenditure is to improve health

This normative position views decision making bodies and institutions as the agents of a principal (e.g., a socially legitimate process such as government) which allocates resources and devolves powers to the agent, giving it a responsibility to pursue specific, measurable and therefore narrowly defined objectives that are regarded as socially valuable, e.g., improving health. In these circumstances economic analysis cannot be used to make claims about social welfare or the optimality or otherwise of the resources allocated to health care. Its role is more modest, claiming to inform accountable decision making, revealing the implied values and exposing the implications of social choices made by the principal. It is this role that economic analysis has tended to play in health policy and underpins much of the evaluation of health care projects and cost-effectiveness analysis that has been conducted (Drummond et al 2015, Coast et al 2008).[3]

2.1 Why discount health?

In this context the reason to discount future health effects cannot appeal to preferences and the type of welfare arguments that underpin STP based on the Ramsey Rule, but instead to the opportunity costs of financing health care. The health care costs of a project could have been invested elsewhere in the economy or used to reduce public borrowing at a real rate of return, which would provide more health care resources in the future and generate greater health benefits. Health care transforms resources into health so from the perspective of a social planner trading health care resources over time is to trade health. Therefore, if health care costs are discounted to reflect the opportunity cost of financing health care, their health effects must be discounted at the same rate.[4] Since the social planner in health care is not able to make investments in the private

[3] See Appendix A section 2.4.3 pages 33-38
[4] This is commonly illustrated by a comparison of terminal and present values. The cost per QALY of a project with immediate costs and additional health benefits all occurring at a future point in time is the same whether

sector the opportunity cost they face is the rate of return on debt reduction rather than higher estimates of the social opportunity cost of capital based on market rates (Spackman 2017). For example, real yields on government bonds reflect the marginal cost of increasing health care expenditure available to government (Paulden and Claxton 2012). In this context the broader question of the social opportunity costs of public expenditure including the macroeconomic choice of levels and mix of taxation and borrowing (Spackman 2017) can be regarded as the responsibility of government rather than spending departments or national and supra national decision making and advisory bodies.[5]

2.2 Representing the effects of health care projects

Estimates of the additional health care costs (Δc) and additional health effects (Δh) (e.g., measured as Quality Adjusted Life Years, QALYs, gained) of a health care project or intervention are commonly presented as incremental cost-effectiveness ratios (ICER).[6] These provide a useful summary of how much additional resource is required to achieve a measured improvement in health (the additional cost per QALY gained). Whether the intervention will improve health outcomes overall, because the cost per QALY it offers is judged to be cost-effective, requires a comparison with a 'threshold' (k) that reflects the likely health opportunity costs, i.e. the improvement in health that would have been possible if the additional resources required had, instead, been made available for other health care activities. A project will improve health overall if the additional cost per QALY it offers is less than the cost-effectiveness threshold ($\Delta c/\Delta h < k$).

Some assessment of health opportunity cost and its evolution over time is required. For example, if the 'threshold' is expected to grow in real terms ($g_k>0$), because the marginal productivity of health care expenditure is expended to decline, then future costs are less important because they will be expected to displace less health. The relative importance of future health care costs can be reflected in the following ways which have different implications for discounting policy:

i. The health benefits and costs of the project can be reported as a time stream of expected health gained and forgone each period (t) by applying the threshold relevant to that period (k_t) to the costs that occur that period ($\Delta h_t - \Delta c_t/k_t$). This time stream of health effects can then be discounted at a rate which reflects a social time preference for health ($D_h=r_h$).
ii. Health benefits can also be valued as the health care resources required to deliver similar benefits elsewhere. The effects of the project can be reported as a time stream of expected health care resources gained and forgone in each period by applying the relevant threshold to the health benefits that occur in that period ($\Delta h_t.k_t - \Delta c_t$). This time stream of health care resources can then be discounted at a rate which reflects the marginal opportunity cost, faced by government, of increasing public health care expenditure (r_s), e.g., real yields on government bonds.
iii. If the effects of a project are reported as a cost effectiveness ratio this must be compared to a single threshold relevant to the current period (k_0). However, some account must be taken of changing health opportunity costs. This can be achieved by discounting the health

costs are expressed at their terminal value when the health benefits occur, or discounting the health benefits back to their present value at the same rate (Nord 2011).

[5] See Appendix B page 108-112

[6] See Appendix A Section 2.4.1 page 27-31 and Appendix B Section 4.2.1 page 79-83

benefits at r_h but discounting the incremental costs at a rate that reflects any growth in the threshold and the relative importance of future costs ($D_c = r_h + g_k$)[7], i.e., a form of dual discounting which reflects expected changes in the marginal productivity of health care expenditure rather than changes in the value of health relative to consumption (Claxton et al 2011).

Most analysis of health care projects and interventions (often implicitly) adopt this type of normative position but generally report results as cost effectiveness ratios rather than net health benefits or the equivalent net effect on health care resources (Phelps and Mushlin 1991, Stinnett and Mullahy 1998).[8] This can be seen as an historic norm which may reflect reluctance on the part of decision making and advisory bodies to be explicit about how much society can afford to pay to improve health and how this is likely to evolve over time.[9] Until recently there has also been a lack of evidence about the likely health opportunity costs (Culyer et al 2007). As a consequence implicit assessments have been embedded in how costs and health effects are discounted. This has contributed to a lack of clarity about discounting policy, what a cost effectiveness 'threshold' ought to represent and how it might be informed with evidence.

2.3 Assessment of health opportunity costs

The problem of estimating a cost-effectiveness 'threshold' that represents expected health opportunity costs is the same as estimating the relationship between changes in health care expenditure and health outcome.[10] Research in the UK has exploited expenditure data by disease area to estimate the effect of change in expenditure on health outcomes (cost per QALY gained) (Martin et al 2008, Martin et al 2012 and Claxton et al 2015a). Estimates are now available for 10 years of data using alternative approaches to estimation. This evolving panel does not provide evidence of growth in the 'threshold' at a time when there was real growth in health care expenditure. A lack of evidence of declining marginal productivity may be due to changes in level and type of demand for health care as well as increases in productivity through improvements in allocative and technical efficiency.

As well as the cost per QALY gained relevant to the UK NHS, the proportionate effect on all-cause mortality of proportionate changes in health expenditure (outcome elasticities) have been derived from disease area level analysis and have also been directly estimated. Research in other higher income countries (Spain, Australia and South Africa) using similar approaches to estimation of within country data have just reported and indicate similar estimates of outcome elasticities in these health care systems. This evidence from higher income settings can be used to give some indication of possible values in lower income countries (Woods et al 2016).

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[7] This approximation is based on the plausible assumption that r_h and g_k are small.

[8] See Appendix B Section 4.2.1 page 79-83

[9] NICE has been the only decision making body to publish an explicit range for the cost-effectiveness 'threshold' used in its deliberative decision-making process (£20,000 to £30,000 per QALY) (NICE, 2004). Although NICE makes clear that the threshold ought to represent the health consequences of additional NHS costs, this range was, in fact, founded on the values implied by the decisions it made between 1999 and 2003 (Rawlins and Culyer, 2004). It has become an established norm, which is intended to represent how NICE makes its decisions rather than an evidence based assessment of the likely health opportunity costs

[10] See Appendix B section 4.3 page 83-94; Section 4.3.3.1 page 95-95

The effect of different levels of health care expenditure on mortality outcomes has been investigated in a number of published studies using country level data, many including low and middle income countries (LMICs) (Gallet and Doucouliagos 2015). The challenge is to control for all the other reasons why mortality might differ between countries in order to isolate the causal effect of differences in health expenditure. This is a particular challenge even if available measures are complete, accurate and unbiased because health outcomes are likely to be influenced by expenditure (increases in expenditure improves outcomes), but outcomes are also likely to influence expenditure (poor outcomes prompt greater efforts and increased expenditure) (Nakamura et al, 2016). This problem of endogeneity, as well as the inevitable aggregation bias, risks underestimating the health effects of changes in expenditure.

Instrumental variables have been used in a number of studies to try and overcome this problem and estimate outcome elasticities for all cause adult and child mortality, by gender, as well as survival, disability and DALYs (Bokhari et al, 2007). These estimated elasticities have been used to provide country specific cost per DALY averted values for 123 countries, taking account of measures of a country's infrastructure, donor funding, population distribution, mortality rates, conditional life expectancies (all by age and gender), estimates of disability burden of disease and total health care expenditure (Ochalek et al 2015). These estimates have recently been updated and work funded by BMGF is underway to assess how cost per DALY averted is likely to evolve with changes in health care expenditure and consumption growth.

Despite considerable data and estimation challenges some initial quantitative assessment of health opportunity costs and how they are likely to evolve is possible based on the balance of evidence such as it is. These initial country specific estimates can be used to report time streams of health care expenditure as health effects or time streams of health benefits as the equivalent health care resources. It means the difficulties and lack of clarity associated with reporting cost-effectiveness ratios and the requirement for dual discounting can be avoided.

2.4 Other impacts

Health care projects often impose costs or offer benefits beyond measures of health and public expenditure on health care; for example the net production effects of improved survival and quality of life (e.g., Meltzer 2013) as well as other social objectives of the decision maker (e.g., equity and financial protection etc.). Some implicit assessment of whether any other benefits can justify net health losses is required in deliberative decision making processes.[11] When other effects include impacts on private consumption opportunities an explicit assessment of the consumption value of health (see Sections 3.1 and 3.2) allows health, health care costs and effects on private consumption to be expressed as either their health, health care resource or consumption equivalents (see 3.1 and 3.2). The explicit assessment of the relative value of other effects shows that the distinction between cost-effectiveness analysis and benefit cost analysis, which incorporates the opportunity of constraints on health expenditure, is more apparent than real. [12] Similarly, although much of the applied work to inform decision making bodies has adopted a narrower health care system

[11] See Appendix B section 4.3.2.4 page 91-94
[12] See Appendix B section 4.3.3 page 94-98

perspective, a broader 'societal' or multi sectoral perspective is possible and is required and recommended by a number of decision making bodies.[13]

Once other effects beyond health and health care costs are included some assessment of the other opportunity costs of health care expenditure (i.e., in addition to health opportunity costs) is also required. Attempts to estimate and explicitly account for these other opportunity costs are particularly limited even in high income settings but do exist. For example, as part of efforts to inform value based pricing of branded medicines (DH 2010 NICE 2014), the DH undertook work to estimate the 'wider social benefits' associated with changes in health outcome. These were characterised as the consumption value of production effects net of the additional consumption due to improvements in survival and quality of life and included valuation of marketed and non-marketed production and consumption, by age, gender, broad areas of disease area (see Appendix B of Claxton et al 2015b).

These types of estimates can provide some default assessment of the net production effects likely to be associated with the particular type of health benefits offered by a health care project. Importantly, they can also be linked to evidence of health opportunity costs to estimate the net production opportunity costs effects of the health care costs of the health care project. For example, the evidence in the UK suggests that a marginal £ in the NHS budget provides 63p worth of net production gains. Although there is little evidence about how this aspect of opportunity costs is likely to evolve, a default assumption that the real value of net production effects of the health effects of changes in health expenditure will grow at the same rate as consumption opportunities would seem reasonable. Such estimates and explicit assessments enable the time stream of net production gains and losses to be considered alongside the time stream of health gains and losses due to the health care and other costs associated with the project.

The implications for discounting policy is that it becomes more difficult and opaque to try and embed all these relevant arguments in how health, health care and other costs are discounted, i.e., reflecting changes in the value of health and in the marginal productivity of health care expenditure in terms of health and net production. The quantification and conversion of multiple effects to a common numeraire may best be done separately and explicitly, reflecting evidence of likely opportunity costs, allowing available evidence to be used transparently and consistently, while preserving the possibility of accountable deliberation about evidence, values and unquantified arguments.

2.5 Time preference for health

The normative position that (often implicitly) underpins much of the evaluation of health care projects, takes the values implied by the outcome of legitimate processes (e.g., government implicitly or explicitly determining public expenditure on health care) as a partial but revealed

[13] See Appendix B Section 4.5.3 page 112-116. For example NICE requires a primary analysis from the perspective of the health care system. However, an analysis that includes other effects can be considered and are required for public health interventions and programs. Other decision making bodies in the Netherlands and Sweden require a broader perspective to be adopted as the primary analysis. A societal perspective was recommended as reference case analysis by the Washington Panel (Gold et al. 1996) , alongside a health care system perspective is recommended in the reference case by the Washington Panel. The recent update to this guidance (Neumann et al 2016) recommends analysis from both a societal and health care system perspective.

expression of some unknown latent social welfare function that may include many conflicting arguments, e.g., health equity, social solidarity among many others that are difficult to specify let alone quantify (Drummond et al 2015). Similarly the social choice of how resources are devoted to health care over time and the resulting health in each period reveals something about society's willingness to trade current and future health, i.e., the choices of the principal in setting budgets based on expectations about the marginal productivity of health care in each period implies values for k_t. Therefore, a revealed social time preference for health[14] can be based on the rate at which government can borrow or save (r_s) and whether the 'threshold' is expected to grow (g_k) because this indicates the relative value (in terms of health care resources) of current compared to future health ($r_h = r_s - g_k$) (Paulden and Claxton 2012).

3 The objective of health care expenditure is to improve welfare

Traditionally economic analysis (e.g., Boadway and Bruce, 1984) adopts a view of social welfare resting on individual preferences revealed through markets and their surrogates or modified by an explicit welfare function. Analysis based on this normative position (e.g., benefit-cost analysis) is less well represented in the evaluation of health projects, partly due to the difficulty of decision making bodies being willing to identify a welfare function carrying some broad consensus or social legitimacy, particularly if health is felt to be unlike other goods (e.g., Broome 1978, Sen 1979, Brouwer et al., 2008, Arrow 2012). Nevertheless, health must inevitably be traded with other welfare arguments, most notably consumption, by social planners whilst taking account of the constraints on health and other public expenditure they face.

This normative position regards purpose of health care expenditure as improving a broader notion of welfare rather than health itself. If consumption and health are the only arguments or are separable from others then decisions which maximise the consumption value of health will also maximise social welfare (Gravelle et al., 2007). In this context the reason to discount future health effects can be based on preferences and the type of welfare arguments that underpin STP based on the Ramsey Rule. This provides a clear link between social time preference for consumption and health (Gravelle and Smith, 2001).

The relative importance of future health care costs and the consumption value of health (v_t) gained and forgone can be reflected in the following ways which have different implications for discounting policy:

i. The health benefits and costs of a project can be reported as a stream of expected health gained and forgone each period by applying the threshold relevant to that period $(\Delta h_t - \Delta c_t/k_t)$. These health effects can be valued by applying a consumption value of health relevant to that period $v_t(\Delta h_t - \Delta c_t/k_t)$. The stream of consumption gains and losses can be discounted at a rate which reflects a STP that would be the relevant rate to apply in all contexts were benefits and costs have been expressed in terms of consumption.

[14] This is the time preference for health, as distinct from pure time preference (for utility) or STP for consumption (see 5 below).

ii. This can also be expressed as a comparison of the cost effectiveness ratio of the project to the current period consumption value of health (v_0) if the discount rate applied to Δh is amended to reflect growth in the consumption value of health ($D_h = r_c - g_v$) and the discount rate applied to Δc is amended to reflect growth in the consumption value of health forgone and changes in the rate at which future health will be forgone ($D_c = r_c - g_v + g_k$) (Claxton et al., 2011).[15]

This approach (in ii) poses more difficulties and potential for confusion, with dual discounting being used to account for changes in the value of health and changes in the marginal productivity of health expenditure as well as time preference. The separate and explicit accounting for each of these effects (in i) would appear more transparent, accountable and comparable.[16]

3.1 Assessing the consumption value of health

There is a large literature which has used stated preferences (contingent valuation and discrete choice experiments) to estimate the consumption value or willingness to pay for a QALY (e.g., Pinto-Prades 2009, Mason et al 2009). The estimates reflect the demand for health and imply what health care expenditure ought to be, rather than a 'supply side' assessment of health opportunity costs. Most estimate how much consumption an individual is willing to give up to improve their own health. A few try to elicit how much individuals believe society should pay to improve health more generally. A wider literature, that extends beyond health, estimates the value of a statistical life (VSL) based on how much consumption individuals are willing to give up to reduce their mortality risk (Hammitt 2000, Robinson et al 2016). Some studies are based on stated preferences (e.g., Lindhjelm 2011) but others identify situations where individuals make choices that imply a value, e.g. revealed preferences in the labour market. A cost per QALY can be derived from these studies by making assumptions about age and gender distribution, conditional life expectancies and quality of life norms.

Recent reviews of this literature reveal wide variation in values (Vallejo-Torres et al, 2016; Ryen and Svensson, 2015;). However, some patterns do emerge: estimates based on VSL studies tend to be higher than those based on willingness to pay for a QALY; values are not proportional to the scale of health gains and differ depending on whether QALY gains are through quality improvement or survival benefits. Reported values also tend to be higher than available estimates of a 'supply side' assessment of health opportunity costs (Vallejo-Torres et al, 2016). This suggests a discrepancy between the demand and supply side of health care systems. For example, if these estimates are regarded as an appropriate expression of social value, the difference would indicate that health care from collectively pooled resources is 'underfunded' compared to individual preferences about health and consumption. However, given the difficulties faced in the public financing of health care and the welfare losses associated with socially acceptable means of taxation this is what might be expected.

The balance of evidence suggests that $v_t/k_t > 1$, which would indicate that public expenditure available for health care is relatively scarce and more valuable than the same amount of private

[15] This approximation is based on the plausible assumption that r_h, g_v and g_k are small.

[16] The UK DH and AAWG 'best practice' report suggests that health opportunity costs are dealt with explicitly and separately from discounting. Nonetheless they recommend a discount rate of 1.5% for health and health care costs and 3.5% for other effects, which embeds the expectation that the consumption value of health will grow at 2%. This happens to nullify the wealth effect in UK Treasury STP based on the Ramsey Rule.

consumption. It is consistent with the view that the public funding of health care is not matching individual preferences and public expectations of their health care system. For example, the UK DH has adopted £15,000 per QALY to assess health opportunity costs and until recently £60,000 per QALY as an estimate of the consumption value of health based on deriving QALY effects from VSL estimates. This would suggest that one health care £ is worth £4 of private consumption effects, which is especially important when there are other impacts which fall outside constrained public expenditure.[17]

The evident difficulties in eliciting willingness to pay for QALY gains means that there is also limited empirical evidence of how these values differ in lower income settings and how they are likely to evolve over time with growth in consumption. However, reviews of the literature that have investigated the relationship between the VSL and income (e.g., Viscusi and Aldy 2003; and Hammitt and Robinson 2011) suggests that earlier cross sectional studies of wage-risk premiums indicate income elasticities <1, but longitudinal or cohort studies typically estimate elasticities >1. (e.g., Costa and Kahn 2004). The reasons for these differences may be that cross-sectional studies are more likely to reflect changes in realised income, whereas longitudinal or across cohort studies are more likely to capture the impact of permanent income (e.g., Getzen 2000; Aldy and Smyth 2014). Despite the empirical difficulties the balance of evidence suggests that the consumption value of health increases with income. Assuming an income elasticity of demand of health ≥1 may not be unreasonable.

There are also sound theoretical reasons why the value of health would be expected to grow with consumption (e.g., Parsonage and Neuburger 1992, Gravelle and Smith 2001, Hall and Jones 2007). The intuition can be expressed in the same way as the expected increase in value of environmental goods; that the growth in consumption is likely to outstrip the growth in health so health will become scarcer relative to consumption. Since consumption is an imperfect substitute for health the value of health will increase. These arguments can be made using behavioural models of individual choices of health affecting activities over time e.g., purchasing health care. The growth in the value of health will be determined by income growth, the income elasticity of demand for health care and the elasticity of the marginal productivity of health care. Alternatively health can be included as a separate argument in a social welfare function where it is valued in its own right, in part, because a healthier state increases the marginal utility of income and an indirect effect through income due to uninsured health care costs and/or increased productivity of being in a healthier state. These insights indicate there are compelling reasons to believe the consumption value of health will grow with income and it is likely to grow at a faster rate if there is a direct effect of health on utility and an indirect effect through income.

Gravelle and Smith 2001, identified a number of special cases. For example if health has no effect on income and the utility effect of health is constant over time then g_v will be equal to rate at which marginal utility of income declines (the wealth effect in the Ramsey Rule). Alternatively, when health affects income but has no direct effect on utility g_v is equal to real growth in income. These special cases just happen to indicate $g_v = 2\%$ (based on the values used by UK Treasury in the Ramsey rule). Although theoretical arguments point to number of empirical questions, a simple but

[17] £60,000 appears somewhat higher than recent reviews of the literature and the UK DH is currently reviewing this estimate. A lower consumption value of health such as £30,000 per QALY would suggest a lower shadow price of public health expenditure (vt/kt = 2).

reasonable assessment could be based on growth in consumption (embedded in the STP) and the income elasticity of demand for health.

3.2 Other impacts

Adopting an explicit consumption value of health allows cost and benefits beyond measures of health and public health expenditure to be included as a stream of consumption gains and losses along-side the stream of the consumption gains and losses associated with health benefits and health opportunity costs. Once the effects on health, health care costs and other impacts are expressed as equivalent streams of consumption they can be discounted at STP.

However, as discussed in Section 2.4, not only are estimates of health opportunity costs over time required to convert the time stream of health care costs into health losses some assessment of the other opportunity costs associated with these health losses is also required. Although there is currently little evidence in lower income setting to support such assessment some default assumption based on what is known about the relationship between changes in health and economic growth would be possible. Such estimates and explicit assessments enable the quantification and conversion of multiple effects to a common numeraire while reflecting evidence of likely opportunity costs and social values. The alternative of embedding these relevant arguments in how health, health care and other costs are discounted appears to be more difficult and opaque limiting the opportunities for accountable deliberation about evidence, values and unquantified arguments.

4 Uncertainty, risk and time horizon

The horizon for many evaluations for health care interventions are often less than 30 years or generally do not extend much beyond that. For example, insofar as a health care intervention impacts on mortality risk the time horizon for costs and benefits need only extend to the survival of the cohort of current beneficiaries. However, projects which change the dynamics of infectious or contagious disease and/or require commitment of irrecoverable costs also require an assessment over the survival of future incident cohorts that will be affected or will benefit from the investment. Similarly the value of information generated by clinical research also includes future patient populations. If all effects are expressed as streams of consumption gains and losses then discounting using STP would be appropriate, including any decline over longer time horizons to reflect the impact of uncertainty it its components.

Considerable efforts have been made in the evaluation of health care projects to characterise all sources of uncertainty, value the consequences and establish how these should inform project choice; for example, whether the approval of a cost- effective project (NPV>0) should be delayed or access restricted until further research is conducted or until sources of uncertainty resolve overtime (e.g., the entry and change in price of competing interventions). The impact of irrecoverable costs and the real option value of delay have been examined as well as the impact of approval on the opportunities to acquire evidence that would benefit future patient populations. The impact of uncertainty on resource allocation across projects under alternative budgetary policies and the

implications uncertain non-marginal budget impacts have also been examined (see Drummond et al 2015, Chapter 11 for an accessible summary).

This type of analysis starts to unpick the reasons for the appearance of risk aversion in project choice and undermines the justification for embedding a common risk premium in discount rates. The evaluation of health care projects is increasingly attempting to explicitly model many of the effects that are otherwise embedded in project specific and catastrophic risk element of STP. Although the application of this type of analysis (value of information, Bayesian decision theory and real options) is well developed in the evaluation of health projects, [18] it is far from universal. Nonetheless, some project evaluations, may have already accounted for the consequences of some of these project specific risks in a way that others in health or other policy and project evaluations may not. Also relatively little consideration has been given to how project specific pro and counter cyclical risk might be reflected in the evaluation of health care policies and interventions. It appears that a common risk premium is unlikely to reflect the consequences of the uncertainty associated with different types of project.

5 Considerations

The two alternative normative positions described above have implications for the valuation of effects and discounting. What distinguishes them is a choice of whether social values ought to reflect those implied by the outcome of legitimate processes (e.g., government setting budgets for health care) or a notion of welfare founded on individual preferences expressed through markets and/or their surrogates. For example, the former suggests a social time preference for health of $r_s - g_k$ and that latter, $r_c - g_v$. The distinction is whether social value is expressed by k_t or v_t and whether it is the opportunity cost of financing health care or the welfare arguments that underpin the Ramsey Rule that justify discounting.[19]

The purpose of this workshop is not to prescribe a particular view or decide whether discounting policies should reflect the normative position that has been adopted in most evaluations of health care projects for decision making bodies, or a broader view of welfare that would be consistent with the welfare arguments that underpin the Ramsey Rule. Rather, the purpose is to clearly set out the implications, for the quantities that need to be assessed, of these alternative normative positions.

Nonetheless, given the importance of being able to explicitly quantify other impacts beyond measures of health and public health expenditure, it may be appropriate to convert all effects into streams of the equivalent consumption gains and losses, while reflecting the opportunity costs of existing constraints. These time streams of equivalent consumption gains and losses can then be

[18] For example, a characterisation of 'all' sources of uncertainty is required by NICE appraisal and value of information analysis is recommended. NICE is considering how more formal analysis of the value of additional evidence and irrecoverable costs can inform it's only in research recommendations.

[19] The actual differences may be modest if g_k and g_v are similar and the real rate at which government can borrow is regarded as a reasonable proxy for STPR as some argue it is (Council of Economic Advisers 2017).

discounted at STP, including any decline to reflect the impact of uncertainty in the elements of the Ramsey Rule. [20]

This approach avoids embedding multiple augments in the discount rate for health and health care costs. The separate and explicit accounting for these arguments allows clarity about the quantities that need to be assessed, available evidence to be identified and used transparently and consistently, while preserving the possibility of accountable deliberation about evidence, values and unquantified arguments in decision making processes.

In addition to the elements of the Ramsey Rule required to estimate STP this also requires the following quantities specific to health to be assessed:

i. Health and other opportunity costs associated with constraints on the growth in health care expenditure and how these are likely to evolve over time;
ii. Opportunity costs of financing health care (and other) public expenditure
iii. Consumption value of health and its evolution over time
iv. Uncertainty in the elements of STP and implications for declining rates
v. How best to reflect project specific and catastrophic risks
vi. How best to aggregate effects across different contexts where these quantities differ

The objective of this workshop is to provide a guide, or algorithm, to assist practitioners and decision makers navigate disputed issues and achieve greater clarity and consistency in the assessment and use of these quantities in discounting policy.[21] The structure of the workshop takes each of the quantities in turn, setting out what type of evidence would be relevant, what is currently known that is relevant to low and middle income settings and how this evidence might be strengthened.

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[20] There will be a decline in the risk free STP due to uncertainty in consumption growth. However, any risk premium included in STP is likely to increase with term structure.

[21] The primary concern for this workshop is consistency between the assessments of key quantifies and how they are related and used. For example, any assessment of future growth in consumption (and its uncertainty) should inform STP, the evolution of the consumption value of health, the rate at which risk free STP declines, any risk premia and, if linked to growth in health expenditure, declines in the marginal productivity of health expenditure.

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