# Estimating the monetary value of health: why and how[1]

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## Abstract

The efficient allocation of scarce health care resources is an important but difficult task. Health economic evaluation, and more specifically, cost-effectiveness analysis, can be a helpful tool for informing these allocation decisions. While some consider comparing costs to health outcomes as an impossible trade-off, it is defensible if made on a collective level, and considering that in a resource constraint setting, costs just quantify what care/benefits need to be sacrificed by others. If one accepts the cost-effectiveness framework, one also accepts its decision rule, which states that a treatment is considered cost-effective if the ratio of cost per QALY is lower than a certain threshold, which is oriented either on what society is willing to pay for a QALY or on the opportunity costs of displaced care. This decision rule implies the necessity for obtaining monetary estimates of the value of a QALY. In previous research, this was mainly attempted by using two conceptually different approaches. First, and more recently, estimates of an opportunity cost based threshold were calculated based on the marginal returns to health care spending, with applications in the UK, Spain, the Netherlands and Sweden. A much larger branch of literature obtained estimates of the societal monetary valuation of a QALY. This was either based on the value of a statistical life (or prevented fatality), obtained through revealed or stated preferences, or on the societal willingness to pay for certain health gains using stated preferences techniques such as contingent valuation willingness to pay experiments or discrete choice experiments. The estimates of the monetary value of a QALY that were obtained are context and approach depended, and also can differ considerably if a similar approach is used in the same context. This chapter will outline an additional

1 Parts of this chapter contain results from two articles by the author:
1. Himmler, S., van Exel, J., Brouwer, W. (2020), "Estimating the monetary value of health and capability well-being applying the well-being valuation approach.", *European Journal of Health Economics* https://doi.org/10.1007/s10198-020-01231-7.
2. Himmler S., Stöckel J., van Exel, J., Brouwer, W. (2020), "The Value of Health – Empirical Issues when Estimating the Monetary Value of a QALY Based on Well-Being Data.", *SOEPpapers on Multidisciplinary Panel Data Research,* 1101. https://www.econstor.eu/handle/10419/224090

alternative approach for estimating the monetary societal valuation of a QALY: the well-being valuation approach. This approach is not strictly based on either stated nor revealed preferences, and entails using regression analysis and observational data. Using life satisfaction (or SWB) as proxy for overall utility, the marginal rate of substitution of the well-being impact of income and health is calculated to obtain a monetary estimate of a QALY. This chapter will also include first results of applying this approach in two different contexts. In one of the applications, we also extent this valuation to a broader well-being outcome measure, namely capability well-being, as extending the evaluative space of economic evaluations is of increasing importance and would also require a monetary valuation of the broader outcome measure. While the well-being valuation approach is not prone to framing biases like willingness to pay experiments, it comes with other caveats like the requirement of obtaining unbiased estimates of the well-being and impacts of income and health, which are notoriously difficult to obtain. Due to methodological differences and context dependency, it may, in general, never be possible to obtain one "true" estimate of the monetary value of a QALY in a society, but future research will further refine the ballpark in which this value may lie, which is informative for decision makers.

Keywords: value of health, QALY, capability approach, economic evaluation, life satisfaction approach

## 1 Introduction

*"The monetary value of one year in full health is €30,000."*

While such a statement seems at least controversial, if not offensive to many individuals, it relates to one of the key questions of the health economics discipline (Culyer and Maynard, 1997): What is the value of health? Asking and attempting to answering this question is not just a provocative thought experiment. It plays an important role in decision making for allocating scarce health care resources in many jurisdictions (Rowen *et al.*, 2017). Also outside of health economics and health care, a valuation of health and life can be pertinent to public policy making. Estimates of the monetary value of a statistical life are for example used for evaluating public policies relating to the environment and transportation safety (Ashenfelter, 2006).

A side note on the interpretation and context of a statement such as the one above: Initially, there may be moral objections to putting a monetary value on health (and therefore life) based on the notion that health is a special good, or a human right, whose value is immeasurable or infinite. Following this notion, health and health care, therefore, should not and cannot be traded-off between population groups or public sectors as the decision rule would be to maximise health no matter the costs. However, it seems that the democratic consensus is that we are not willing to invest all available resources in health care (increasing population health and survival), but also want to invest in other goods such as education, transportation or private consumption. That we do trade-off health to other goods has rarely been as obvious as during the current COVID-19 outbreak, where economic considerations of lockdown measures are directly weighted against health and lives of citizens. While governments may still claim that they are not willing to trade of lives for a less severe economic downturn (e.g. Olaf Scholz, the German minister of finance[2]), they are in essence doing exactly that by gradually relaxing lockdown measures even though the pandemic is not over, accepting a certain number of infections and deaths. An ordinary example for "sacrificing" your own health and the health of others on a more individual level would be the motorised private transport. In Germany in 2019 alone, 300,200 individuals were injured and 3,059 died as a results of road accidents (Destatis, 2020). The numbers for public transportation are almost at zero. Admittedly, public transportation is not a valuable alternative for many individuals, but those, who do use their own car instead public transport (if available), do this with the knowledge that they are risking theirs and others' health for gains in time and comfort. On a societal level, there seems to be the consensus that injuries and fatalities do not warrant a much higher investment in means of public transportation. Therefore, given these trade-offs, it is apparent that the value of health and life is not infinite. A second objection to the statement above may be that the value of health is expressed in monetary terms. However, money is the smallest common denominator in our society and the value has to be expressed that way to be informative for policy making as it relates decisions on the allocation of public budgets and funds.

Using and expanding the rational and the technical application of health economic evaluations and concepts like the Quality Adjusted Life Year (QALY),[3] this chapter will in particular advance as follows: First, it will be argued why the use of cost-effectiveness analysis, in general, is ethically justifiable and why its decision rule requires the estimation of a monetary value of health. Second, this chapter will provide an overview of the previously used methodologies and the corresponding results of previous attempts to estimate a monetary value of a QALY. Third, an alternative approach will be presented and first results from two studies estimating the monetary value of a QALY based on the well-being valuation approach will be summarised. One of the studies also

2 https://www.faz.net/aktuell/wirtschaft/corona-kirse-scholz-gegen-lockerung-wegen-wirtschaft-16701835.html (accessed 2 December 2020).

3 These frameworks and concepts are summarised in the previous chapter by Mitchell.

provides a corresponding estimate for a year in full capability well-being.[4] Lastly, this chapter will be put into a broader context.

## 2 Ethics of cost-effectiveness and its decision rule

There is increasing pressure on health care budgets due to an ageing population and the development of new (expensive) treatment options. Drastically expanding health care budgets aiming to provide all possible treatment options to everyone at any time does not seem to be a realistic way forward as outlined above. This raises the question, how decision-makers can decide on whether to reimburse certain health care services (or products) or not. Among many jurisdictions this assessment is operationalised using cost-effectiveness analysis (Rowen *et al.*, 2017), where the incremental costs of a new technology are compared to the expected incremental health gain it generates, which is measured using Quality Adjusted Life Years (QALYs) (Neumann *et al.*, 2016). On a side note, the QALY framework operates based on a certain understanding of health and disease, which in turn implies certain assumptions about the idea of the value of a medical interventions.[5] Furthermore important to note here, is that in countries like Germany or France, cost-effectiveness analysis and the QALY framework are not used in health technology assessment. The reasoning behind rejecting this approach more or less relate to either measurement concerns or moral objections. The following will touch on both aspects.

Coming back to the cost per QALY framework: Comparing health outcomes to costs of a treatment, may ultimately lead to some treatments not being available for certain patients based on partly monetary considerations. There are two aspects, which may be worth highlighting here, which, among other ethical considerations, were first (and likely better) formulated by Williams in the early days of QALYs and cost-effectiveness analysis (Williams, 1992; Williams, 1996):

First, economic evaluations support *collective*-priority setting in health care. This means that they are used on a health care level, somewhat detached from the clinical level without specific knowledge, who the patients are that are affected by certain decisions. While this is not exactly a 'veil of ignorance' as described by Rawls (Rawls, 1972), this detachment is the best option for allowing interpersonal judgements of life's value, which priority setting essentially is.

Second, when speaking of costs of a treatment and accepting that health care resources are limited, costs should be seen as 'what will have to be sacri-

[4] This is also related to the concepts defined in the chapter by Mitchell.

[5] The chapter by Stutzin Donoso discusses in detail that there competing interpretations are possible.

ficed' and especially what sacrifices have to be imposed on others. Every Euro spent on a certain treatment for one patient, may have been put to better use for another patient, whose health gains are now not realised. Williams (1992) considers disregarding costs in treatment decisions, meaning ignoring the sacrifices and subsequent adverse consequences imposed on others, as unethical. The use of QALYs as outcome measures is also not without limitations and includes several ethical concerns, which will not be discussed here, but are discussed in detail for example by Williams (1996) or Pinkerton *et al.* (2002).

If one accepts the notion that costs and effects of interventions have to be compared, the need for a monetary value for health can be derived from its decision rule. Equation (1) formulates the corresponding decision rule, with $\Delta E$ denoting the health gain (in QALYs) and $\Delta C$ the total costs compared to the alternative treatment:

$$\frac{\Delta C}{\Delta E} < v_Q \qquad (1)$$

Taking a societal perspective, like is used in the Netherlands, this ratio, also called incremental cost-effectiveness ratio (ICER), is acceptable if it lies below the consumption value of a QALY $v_Q$, the so called threshold value, which would lead to a positive reimbursement decision for the health technology (Brouwer *et al.*, 2019). The consumption value of health $v_Q$ is the monetary value society attaches to one year in full health. In the Netherlands, $v_Q$ is dependent on disease severity and the adaptive threshold value ranges from €20,000 to €80,000 per QALY. In the UK, the threshold value $v_Q$ relates to the marginal cost-effectiveness of current spending in the health care system and was set to £20,000–30,000 per QALY (Claxton *et al.*, 2011).

Without estimates or values for $v_Q$, the results of cost-effectiveness analyses are considerably less informative. Although it would still be possible to compare the ICERs of different interventions and assess which is more cost-effective, one could not assess whether the ICER of a certain intervention is still acceptable. Are costs of €100,000 per QALY for a certain intervention too much? Where should the line be drawn, if one accepts that health care budgets are limited and the value of health is not infinite? Explicit threshold values have not been formulated in many countries, and some countries, like Germany, even completely reject the cost-effectiveness framework altogether (Rowen *et al.*, 2017). However, one needs to be aware of that even then, every decision on reimbursing (or not reimbursing) a certain health intervention to a certain price, implicitly produces a cost per QALY ratio for the specific intervention and disease area. Whether formulating and using an explicit threshold value leads to more efficient reimbursement decisions is not clear (yet), however such a system wide threshold would allow for a more transparent decision making.

# 3 Previous approaches for estimating the monetary value of a QALY

If and on what basis the threshold value $v_Q$, i.e. the value of health, is defined and used in health technology assessment varies widely across jurisdictions (Cameron *et al.*, 2018, Cleemput *et al.*, 2011). Due to its implications and importance, any such threshold value should have a strong empirical basis, which oftentimes may not be the case (Cameron *et al.*, 2018). A common challenge is that obtaining valid and informative estimates of $v_Q$ is inherently difficult. There are currently two distinctly different types of methods based on demand sided approaches and supply sided approaches.

The latter approach entails estimating $v_Q$ based on current health care spending and more specifically the marginal (health) returns to health spending. This value is often referred to as k-threshold (Brouwer *et al.*, 2019). The conceptual idea of the approach is the following: Given fixed health care budgets, the introduction of new health technologies is assumed to displace other existing treatments. The cost of implementing the new technology is then equal to the health foregone due to the displacement, i.e. the health opportunity cost. The threshold then represents the point at which more health is forgone than gained and is calculated as the average cost-effectiveness of all technologies and services that are displaced based on health spending data linked to health outcomes (van Baal *et al.*, 2019). In the first application of this approach, the k-threshold for the UK was estimated to be £12,936 per QALY (Claxton *et al.*, 2015). Similar studies have been conducted in Spain, with k-values of around €25,000 per QALY (Vallejo-Torres *et al.*, 2018), the Netherlands, with a base case estimate of €41,000 per QALY (van Baal *et al.*, 2019), and most recently in Sweden, where the marginal cost per life year was estimated to be €39,000 (Siverskog and Henriksson, 2019). While these kind of estimates are not affected by the shortcomings of stated preferences approaches and provide conceptually different valuations of a QALY, they do have limitations of their own. These mainly relate to the availability of suitable data (both on health care spending and outcomes) and the issues related to obtaining unbiased estimates of the effect of health care spending on mortality/morbidity. This type of approach is also most relevant in countries, which orient the threshold value on opportunity costs.

Demand sided approaches to estimating $v_Q$ have a strong connection to welfare economics, as they relate to the societal willingness to pay (WTP) for a QALY. The cost per utility (QALY) of an intervention and this societal WTP then give a direct indication of the welfare impact of a health technology (Ryen and Svensson, 2015). There are two main empirical conceptualisations of obtaining this societal WTP: First, the value of a statistical life approach, which calculates the monetary value of preventing fatalities and is also used for evaluating public policies relating to the environment and transportation safety (Ashenfelter, 2006). This approach entails estimating the marginal rate of substitution between some welfare variable (wealth, income) and mortality risks either using stated preferences (hypothetical market situation) or revealed preferences methods (actual market behaviour). In a second step the value of a statistical life is converted to $v_Q$ by relating this to the expected remaining life expectancy and quality of life with discounting future streams (Hirth *et al.*, 2000). There are large methodological differences between studies, and the corresponding range of $v_Q$ goes from €21,815 to €1,204,963 per QALY according to the review by Ryen *et al.* (2015), which included three such studies with 41 estimates. In a study that used a single estimate of the value of a statistical life for the UK (Mason *et al.*, 2009), $v_Q$ was estimated between €32,319 and €94,606. The drawback of the value of a statistical life approach is evident by these ranges: There are large degrees of freedom on how to estimate the value of a statistical life and on how to convert this to $v_Q$. It is therefore difficult to assess, which estimates should be used to inform the cost-effectiveness threshold.

A second demand sided approach, which is more commonly applied, is to ask representative samples directly about their WTP for incremental health or QALY gains using surveys and then aggregate these estimates to the WTP of a full QALY. While this was also done using discrete choice experiments (Gyrd-Hansen, 2003; van de Wetering *et al.*, 2015), willingness to pay contingent valuation methods were predominantly used (Nimdet *et al.*, 2015). These entailed for example describing two different health states (e.g. using EQ-5D profiles) and asking about how much individuals would be willing to pay for avoiding to be in the worse state. As the reviews by Ryen *et al.* (2015) and Nimdet *et al.* (2015) showed, there are however considerable differences in the design of such studies: Firstly, this relates to more conceptual differences as an individual or societal perspective (including altruistic motives), the type of population, whether to include only quality of life or also life expectancy, or whether scenarios were disease specific or about changes in general health (Ryen and Svensson, 2015). Secondly, there are various different types of elicitation procedures, like open-ended questions, bidding games, payment cart designs, dichotomous choice, or a combination thereof (Nimdet *et al.*, 2015). This flexibility in designing such studies can be considered as a strength as it allows researchers to customise the design, control for certain influences, and adopt it to different contexts. However, this is also one of the reasons why estimates of $v_Q$ vary widely across studies. Ryen *et al.* (2015) found a range across 24 articles going from less than €1,000 to €4,800,000 with trimmed mean and median estimates of €74,159 and €24,226 (in 2010 price levels) for one QALY. Another reason for finding such differences is that the framing of these questions and type of elicitation format plays an important role for the WTP results, which was specifically shown for example by Gyrd-Hansen *et al.* (2014) or Ahlert *et al.* (2016). This relates to the more general limitations of such stated preferences approaches, which lie in hypothetical response bias, insensitivity to scope or framing effects (Kling *et al.*, 2012).

## 4 The well-being valuation approach

A third and most recently developed demand sided approach for estimating $v_Q$ is the so called well-being valuation approach, which has so far only been applied once in a study by Huang *et al.* (2018), and will be discussed in detail in this chapter. In this first application, $v_Q$ for Australia was estimated to be between A$42,000–A$67,000 per QALY. In contrast to willingness-to-pay experiments, the well-being valuation approach does not directly ask individuals for a willingness to pay for a certain health gain, but relies on regression analysis and the well-being impacts of health and income to obtain a societal valuation of health. More specifically, the well-being valuation approach uses observational data to assess the experienced average impact of a change in a good on individuals' overall utility $u$, proxied by subjective well-being (SWB) or life satisfaction, and calculating the change in income necessary to maintain the same level of utility (Dolan and Fujiwara, 2016). This obtained monetary valuation is also known as compensating income variation (CV). To paraphrase, CV is the hypothetical, average amount of money you would need to give an individual so that he or she would be equally happy after imposing a certain change in his or her circumstances. In the following, this change in circumstances is a certain hypothetical change in health.

Therefore, while based on individual survey data, this approach is not a stated preferences approach, but also not a classical revealed preferences approach, as it does not involve actual market behaviour (Dolan and Fujiwara, 2016). The following will outline the conceptual model used for 1) estimating $v_Q$ and an equivalent value for a year in full capability based on UK data and 2) estimating $v_Q$ using large scale panel data from Germany. To quickly recap, the ICECAP-A would extend the evaluative space of health economic evaluations to capability well-being instead of a sole focus on health.[6] If this evaluative space is extended, it is important also to obtain estimates of the monetary value of a year in full capability (equivalent to $v_Q$) to be able to assess whether a certain interventions is cost-effective or not.

Applying the well-being valuation approach for estimating monetary values of capability well-being and health requires the following assumption about the relationship between health, capability and SWB: Individual's overall utility $u$, as proxied by SWB or life satisfaction ($w$), is a function of health or capability well-being $h$. This assumption is in conflict with how some see the

[6] Capability well-being, its potential role in health economic evaluations and its measurement via the ICECAP-A is described in the previous chapter by Mitchell.

relationship between capability, utility and SWB (Veenhoven, 2010), but it is a necessary assumption due to the mechanics of the well-being valuation approach. The conceptual model of the well-being valuation approach can be summarised as follows (this model was previously described by Ólafsdóttir *et al.*, 2020):

$$u(h, y, x) = SWB(h, y, x) \quad (2)$$

Utility $u$ is determined by health or capability well-being $h$, income $y$, and certain individual and socioeconomic characteristics summarised in vector $x$. An imposed health deterioration from h1 to h0 results in the utility decrement $\Delta u$:

$$\Delta u = u(y, h^0|x) - u(y, h^1|y) \quad (3)$$

The marginal rate of substitution or compensating income variation ($CV$) is the size of the change in income $y$ necessary to equalise $u$ before and after the health deterioration.

$$u(y \; + CV|h^0, x) = u(y|h^i, x) \quad (4)$$

Empirically, $CV$ is estimated in two steps. First, the impact of income and health on SWB (or $u$) is calculated using regression analysis, controlling for demographics and possible confounders. Second, the coefficient estimates, which represent the marginal effects of income and health on SWB, are then divided by each other to obtain the marginal rate of substitution (or compensating variation) of income and health.

While the well-being valuation approach avoids some challenges associated with stated preferences methods, the use of observational data limits the scope to respondents' ex-post valuations with for example no means for explicitly including a societal perspective. Furthermore, endogeneity concerns are a prevailing issue of this approach as it relies on the estimation of causal effects of health and income to calculate their marginal trade-offs. While some of these concerns can be addressed, this has to be acknowledged when interpreting the results.

## 5 Applications of the well-being valuation approach

The following will summarise approaches and preliminary results for estimating $v_Q$ based on the well-being valuation approach in two different context and based on two different types of data.

## *5.1 The value of a QALY and a year in full capability in the UK*

In this case study, we estimated $v_Q$ if its scope is limited to health and if it is extended to broader capability well-being ($v_C$) as measured through the ICECAP-A (Al-Janabi *et al.*, 2012). We applied the well-being valuation approach to calculate a first monetary value for capability well-being in comparison to health, derived by utility weighted ICECAP-A and EQ-5D-5L values (corresponding to *h* in the above outlined framework), respectively (Devlin *et al.*, 2018; Flynn *et al.*, 2015). Data on health or well-being state *h,* life satisfaction *w,* and a number of control variables *x*, was obtained through an online survey, which was administered to a representative sample of UK citizens aged 18 to 65 (N=1,512) in February 2018. To overcome the endogeneity of income, a well-known issue in the well-being valuation literature (see e.g. Howley (2017) or Huang *et al.* (2018)), we applied an instrumental variable regression. The estimated impact of health or capability well-being *h* (summed up to 1 QALY or 1 year in full capability) on life satisfaction, the utility proxy, was then used to obtain estimates of $v_Q$ and $v_C$.

Using the instrumental variable specification and a commonly applied logarithmic specification of income, our base case estimate of $v_Q$ was £30,786 per QALY. The corresponding value for $v_C$, a year in full capability, was £66,597. The $v_Q$ estimates compared well to previous estimates for the UK based on the value of a statistical life and willingness to pay experiments (Baker *et al.*, 2010; Mason *et al.*, 2009), while also being relatively close to NICE's threshold value (Claxton *et al.*, 2011).

This first application is not without limitations, which mainly relate to obtaining unbiased estimates of the impact of income on life satisfaction. However, this is especially challenging in this rather small, cross-sectional sample. Assuming that the relative magnitudes of $v_Q$ and $v_C$ are unaffected by this, this application showed that if one would extent the evaluative space from health to capability well-being, a differential, larger threshold should be used in economic evaluations using the ICECAP-A measure. A more conceptual concern of this analysis lies in applying a utility-based approach to a capability measure. Utility and capability represent different concepts of value and their relationship and potential integration is not straightforward and will be subject of future research.[7]

Across different model specifications, the value of $v_C$ was between 1.7 to 2.6 times larger than $v_Q$. A larger value could have been expected as capability well-being is broader (and more closely related to overall experienced utility) than merely health, but has not been empirically shown before. In a patient setting, capability well-being may capture care-related as well as medical or

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[7] This was also pointed out in the previous chapters by Mitchell and Ubels in this publication.

functional needs, while health as measured by the EQ-5D would be somewhat limited to the latter. This broader scope of capability instruments, covering both cure and care-related dimensions, was one of the rationales behind their development.[8] Hence, they might in particular be useful for a value-based assessment of settings with a broader understanding of cure and in particular care (e.g. long-term care, social care), where recipients represent rather clients than patients.

## 5.2 The value of a QALY in Germany

In this second application, we started out with the aim of estimating $v_Q$ for Germany, as so far only one study provided such estimates based on willingness to pay experiments (Ahlert *et al.*, 2016). Their study was aptly called "How you ask is what you get [...]" referring the range of $v_Q$ estimates they obtained from different contingent valuation designs (€3,911 to €43,115). The approach we used was similar to the one used by Huang *et al.* (2018) as we based our estimation on large-scale panel data. For this analysis, we used data from the German Socio-Economic Panel (SOEP) from 2002 to 2018 containing a final analysis sample of 29,735 individuals followed over multiple periods. The panel structure allowed us to run fixed effects regressions, removing the potential bias due to time-invariant unobservables. To further attempt to obtain unbiased estimates of the impact of income on life satisfaction, we applied an instrumental variable approach based on the industry-wage structure (Luechinger, 2009). The richness of the data furthermore allowed us to explore several empirical issues in applying the well-being valuation approach to valuing QALYs. This especially includes different functional form assumption of income (logarithmic, multiple income splines) or the or the health state dependence of the marginal utility of consumption (Finkelstein *et al.*, 2013).

The baseline fixed effects and instrumental variable regressions provided $v_Q$ estimates of €58,533 and €22,717 per QALY for Germany. Estimated values varied across model specifications with the bulk of estimates lying between €20,000 and €60,000 and most instrumental variable estimates remaining rather stable around €20,000 per QALY. These estimates are somewhat larger compared to what has been found by Ahlert *et al.* (2016). Our study, which will be published in due course, furthermore adds to methodological and empirical challenges of applying the well-being valuation approach, in general, and for estimating the monetary value of a QALY in particular. Important to note here is that our estimates will not directly be relevant to health care decision making in Germany, as cost-effectiveness analysis is currently not used. While the

[8] This is also discussed in the chapter by Mitchell.

arguments against using this framework – measurement issues or moral objections of e.g. putting a monetary value on health – are valid concerns, it needs to be acknowledged that the currently applied process has certain undesirable characteristics on its own: In Germany, new health technologies are only compared within an indication set (a certain disease) with no explicit comparison of costs and benefits. This process, for once, could lead to the situation that society (unknowingly) is paying a lot more for the same benefit in one disease compared to another disease. Within a cost-effectiveness framework, this differential weighting is more explicit (e.g. using a disease severity adaptive threshold like in the Netherlands) (Brouwer *et al.*, 2019).

## 6 Concluding remarks

This chapter attempted to illustrate (1) the ethics and decision rule of cost-effectiveness analysis (2) the subsequent need for obtaining monetary valuations of health if the principles of cost-effectiveness are accepted (3) how such values were previously estimated, and (4) presented a novel approach and first results from two studies also including monetary estimates of years in full capability well-being.

Coming back to the statement from the beginning of this chapter: While it should now be clear to readers, why such a value is needed and how it can be obtained, the following needs to be acknowledged: Although obtaining one "true" monetary value for a QALY in a society would be desirable (e.g. the €30,000 per QALY) as it would be most informative for decisions makers, obtaining such a value is not feasible. As becomes apparent from sections 3 and 4, estimates do not only differ considerably between conceptually different approaches, but also within the approaches themselves. The novel approach that was outlined and applied, is also not without limitations, but adds to this insofar as it further confirms and refines the *ballpark* of $v_Q$ estimates from an individual perspective of between €20,000 and €60,000 for Germany and of around €30,000–40,000 per QALY for the UK. Future research into the application of the well-being valuation approach, willingness to pay experiments and the marginal returns of health spending to obtain monetary values of a QALY, will be valuable to further refine this ballpark. Another interesting observation from this chapter is that monetary estimates of a QALY based on opportunity costs (k-threshold) seem to be lower than estimates based on the societal value of a QALY. This implies that the health care budget is not set optimally and that there is underinvestment in health care (Brouwer *et al.*, 2019).

Independent of jurisdiction, given the ageing of western societies, the threats of global outbreaks, and, most importantly, the explosion of what is and will be medically possible in the near future, an efficient, equitable and transparent allocation of health care resources will be crucial. The cost-effectiveness framework and its decision rule based on what society is willing to pay or what has to be given up for certain health gains, or likely increasingly, certain well-being gains, can be one important tool to aid in achieving this. If countries like Germany will also make use of this tool in the future remains to be seen.[9] As a last remark, results from health economic evaluations rightfully are not, and likely never will be, the only basis on which decisions about which interventions should be made available to what patients will be based on. It merely represents the health economic perspective. Other ethical, medical, sociological or practical considerations should always play a role as well.

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[9] As is highlighted in the chapter by Buch *et al.*, other tools could relate to creating innovative reimbursement schemes for medical interventions.

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