Social Science & Medicine 211 (2018) 131–136

Contents lists available at ScienceDirect

Social Science & Medicine

journal homepage: www.elsevier.com/locate/socscimed

Life satisfaction, QALYs, and the monetary value of health

Li Huang[a,*], Paul Frijters[b], Kim Dalziel[a], Philip Clarke[a]

[a] Centre for Health Policy, Melbourne School of Population and Global Health, The University of Melbourne, Melbourne, Australia
[b] Centre for Economic Performance, London School of Economics, London, United Kingdom

ARTICLE INFO

Keywords:
Australia
Wellbeing
Life satisfaction
QALY
Value of health

ABSTRACT

The monetary value of a quality-adjusted life-year (QALY) is frequently used to assess the benefits of health interventions and inform funding decisions. However, there is little consensus on methods for the estimation of this monetary value. In this study, we use life satisfaction as an indicator of 'experienced utility', and estimate the dollar equivalent value of a QALY using a fixed effect model with instrumental variable estimators. Using a nationally-representative longitudinal survey including 28,347 individuals followed during 2002–2015 in Australia, we estimate that individual's willingness to pay for one QALY is approximately A$42,000-A$67,000, and the willingness to pay for not having a long-term condition approximately A$2000 per year. As the estimates are derived using population-level data and a wellbeing measurement of life satisfaction, the approach has the advantage of being socially inclusive and recognizes the significant meaning of people's subjective valuations of health. The method could be particularly useful for nations where QALY thresholds are not yet validated or established.

1. Introduction

The methods for assigning monetary value to health or quality-adjusted life-years (QALYs) form the foundation of the modern application of cost-effectiveness analysis, where a threshold is used to determine whether an intervention is cost-effective and the resulting recommendations for funding. A recent systematic review on willingness to pay for a QALY (Ryen and Svensson, 2015) identified 24 published studies, with the overwhelming majority using the stated preference method, such as various forms of contingent valuation which uses hypothetical questions to directly ask about individual's willingness to pay to move between health states. As the review by Ryen and Svensson (2015) highlights these studies have produced a wide range of estimates for the willingness to pay for a QALY with a mean across all studies being €118,839 and a median of €24,226.

A different, but growing literature uses subjective wellbeing valuation methods to calculate the shadow price of health. Compared with stated preference methods which rely on expected utility under hypothetical scenarios, the well-being valuation method examines the impacts of life circumstances based on revealed preference (for a more detailed discussion on stated and revealed preference methods, see for instance Dolan and Kahneman, 2008; Mark and Swait, 2004; and McPherson et al., 2004). Examples of well-being valuation studies include Ferrer-i-Carbonell and van Praag (2002), Groot and van den Brink (2004), Powdthaveea and van den Berg (2011), Oswald and Powdthavee (2008) and McNamee and Mendolia (2014) where the equivalent income for specific diseases, disabilities and pains was estimated. The wellbeing valuation method has also been used to monetarize other non-market commodities such as marriage, crime and informal care (see for instance, Clark and Oswald, 2002; Moore and Shepherd, 2006; van den Berg and Ferrer-i-Carbonell, 2007). Typically for this approach, a measure of subjective wellbeing is regressed on income and health conditions along with other socio-economic variables. The trade-offs between income and the health conditions are then estimated so that the income equivalence that is necessary for the individual to achieve the level of wellbeing before health deterioration can be approximated.

To date the wellbeing valuation studies in health have focused on broad categories of disease such as migraine and diabetes (Groot and van den Brink, 2004; Powdthaveea and van den Berg, 2011), which limit its applicability in economic evaluation where the most common outcome is to measure health using generic preference-based measures such as QALYs.

This study advances the wellbeing valuation method and uses general life satisfaction with a generic measure of health, the short form 6-dimensions (SF-6D), to estimate the dollar value of a QALY. Unlike previous wellbeing valuation studies where either a monetary compensation (also termed willingness to accept) was estimated or a general equivalent income was presented without further distinctions on willingness to pay or accept, we explicitly provided an estimate of

* Corresponding author.
E-mail address: li.huang@unimelb.edu.au (L. Huang).

https://doi.org/10.1016/j.socscimed.2018.06.009
Received 4 January 2018; Received in revised form 13 June 2018; Accepted 15 June 2018
Available online 18 June 2018
0277-9536/

willingness to pay using an instrumental variable approach. Also, by using the SF-6D which is a preference-based health measure that can be used to describe more than 18,000 health states and generate QALYs (Whitehurst et al., 2011), we extended the potential empirical application of the wellbeing valuation method from monetarizing specific illnesses to monetarizing various conditions. Hence, with the estimated willingness to pay, we are attempting to facilitate a net-benefit approach to economic evaluation.

The rest of the paper is organized as follows: Section 2 introduces the conceptual framework. Section 3 describes the empirical method and the data. Section 4 presents the results and examples of how the results can be applied. Section 5 concludes.

2. Conceptual framework

For simplicity, we assume that an individual's wellbeing depends on income y and health h. The individual's wellbeing in period t can be described as

$$W_{it} = W(Y_{it}, H_{it})$$

where Y_{it} is a vector of incomes y_{it} from the past up till the present, hence allowing incomes from the past to affect current wellbeing, for instance via savings or adaptation; H_{it} is a vector of health outcomes h_{it} from the past till the present, allowing past health to affect current outcomes, for instance via effects on social capital or adaptation.

We can define the wellbeing an individual experiences in a T-year interval as

$$W_i(Y_i, H_i) = \sum_{t=0}^{T} W(Y_{it}, H_{it})$$

where T could be a year, a decade, or a whole lifetime and Y_i and H_i now denotes income and health over the whole time-span. Consider then an individual who experiences a change in their health vector ΔH_i in this T-year window. The income change ΔY_i that is equivalent to this health change is now the income change that holds wellbeing constant and thus solves

$$W_i(Y_i, H_i) = W(Y_i + \Delta Y_i, H_i + \Delta H_i) \quad (1)$$

Now, because the equivalence holds for the sum of wellbeing over the T-year window, there are in principle an infinite number of vectors ΔY_i that equalize a health change and thus could constitute a willingness to pay. One important scenario is a lump-sum payment for a particular health improvement over the T-year rolling window, and the payment could be made at either the start or end of the T-year rolling window. We are also interested in the willingness to pay in the current year (or the most recent year of the T-year rolling window) for a sustained health improvement still enjoyed in the current year, which represents the long-run equilibrium payment for a sustained health improvement.

It is important to realize that equation (1) will be measured by using levels of wellbeing experienced, rather than anticipated levels of wellbeing. Hence, we identify the equivalent income that maintains wellbeing therefore measuring the willingness to pay of a ‘rational’ individual.

3. Empirical methods

3.1. Model

In the model to be considered, we use a T-year rolling window (T = 2) of variables

$$LS_{it} = a + b_0 \cdot SF-6D_{it} + b_1 \cdot SF-6D_{it-1} + c_0 \cdot LTC_{it} + c_1 \cdot LTC_{it-1} + d_0 \cdot Y_{it} + d_1 \cdot Y_{it-1} + g \cdot X_{it} + \lambda_i + \delta_t + u_{it} \quad (2)$$

where LS_{it} refers to the life satisfaction for individual i in time t , $SF-6D_{it}$ is the generic health utility score, LTC_{it} is a dummy variable indicating long term health conditions (termed LTC), Y_{it} is the equivalised household income of the individual at time t where equivalised income was obtained by weighting the household income by how many members are in the household with a weight of 1 applied to first adult, 0.5 to an additional adult and 0.3 to each child (Hagenaars et al., 1994); λ_i is an unobserved time invariant individual factor, δ_t is a year fixed effect, and u_{it} is an error term. A conventional vector of other socio-economic variables that could have an impact on life satisfaction is included and represented by X_{it} , which incorporates age, marital status, education, leisure capacity, and unemployment.

Here health is described by the SF-6D and LTC, and willingness to pay approximated by income. We have chosen a rolling window of T = 2 years (t and t-1) to allow for the estimation of a willingness to pay over a relatively short period of time, as well as the capture of adaptation effect of income and health (see Appendix Method S1 for an illustration of the equations for T = 3 [INSERT LINK TO ONLINE FILE A]). With the dynamic specification, the effect of a health utility change is described by $b_0 + b_1$ and the total effect in accumulated health utility over the 2-year window is then $T*b_0 + (T-1)*b_1$. Similarly for the effects of a LTC where the total accumulated effect of a change is $T*c_0 + (T-1)*c_1$.

The dynamic specification also allows us to compare the importance of income and health changes over time: the total effect of a permanent income change is $d_0 + d_1$ per dollar per year and a permanent health change is $b_0 + b_1$ and $c_0 + c_1$.

Therefore, the amount of money that individuals should be willing to give up for a health change given a constant level of $(LS_{it} + LS_{it-1} + LS_{it-2} + ... + LS_{it-T+1})$ can be estimated as follows. The average willingness to pay per year for maximum health utility improvement (hence $\Delta SF\text{-}6D = 1$ or $\Delta QALY = 1$ based on the interval scale property of SF-6D and the annual structure of HILDA) and for not having a long-term health condition ($\Delta LTC = -1$), which we term WTP_S and WTP_L , in the T-year window (T = 2) can be estimated as:

$$WTP_S = ((T*b_0 + (T-1)*b_1)/(T*d_0 + (T-1)*d_1)$$

$$WTP_L = ((T*c_0 + (T-1)*c_1)/(T*d_0 + (T-1)*d_1) \quad (3)$$

In terms of the long-run equilibrium for a sustained health improvement, the willingness to pay is estimated as:

$$LRWTP_S = (b_0 + b_1)/(d_0 + d_1)$$

$$LRWTP_L = (c_0 + c_1)/(d_0 + d_1) \quad (4)$$

3.2. An instrumental variable approach

A major concern of our empirical strategy as described by equation (2) is that, when one controls for time invariant individual traits (fixed effects) which could be correlated with both life satisfaction and income, the estimates are largely influenced by income changes that are prone to high measurement error. Measurement error could arise from income changes that people are unaware of or would not interpret as meaningful, such as changes due to an updated pension policy or inflation. We also have some concern over the asymmetry effect of income on wellbeing, namely that the effect of a loss of one dollar is generally greater than the effect of a gain of one dollar (Tversky and Kahneman, 1991), implying that forcing income to have a single coefficient over loss and gain could bias the estimated willingness to pay upwards.

Owing to the strong likelihood of an endogeneity bias of income due to measurement error, an instrumental variable is required. We use financial worsening event which is available from the HILDA survey as instrument for income as inspired by Mervin and Frijters (2014) and Frijters et al. (2011). Financial worsening event is by definition correlated with income and can be assumed to affect life satisfaction through