Well-being and the value of health

Happiness and Public Policy Conference
Bangkok, Thailand
18-19 July 2007

Bernard van den Berg

Department of Health Economics & Health Technology Assessment, Institute of Health Sciences,

Faculty of Earth and Life Sciences, VU University, Amsterdam, The Netherlands

Version: 16 June 2007

Preliminary results: please do not quote without permission of the corresponding author!

Address of correspondence: Bernard van den Berg, VU University Amsterdam, Faculty of Earth and Life Sciences, Institute of Health Sciences, Department of Health Economics & Health Technology Assessment, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands. Tel +31 20 598 2545, Fax +31 20 598 3668, Email: bernard.van.den.berg@falw.vu.nl.

Summary

This paper contributes to the literature by presenting a new way to calculate the societal willingness to pay for improvements in health-related quality of life. It combines the value of life and the health-related quality of life literatures using the well-being valuation method. By estimating the association between health-related quality of life and self reported well-being and between income and self reported well-being it is possible to calculate the societal willingness to pay for improvements in health-related quality of life. This is done by keeping well-being constant and measuring the association between income and health. In economic terms the marginal rate of substitution between health and income is calculated by assessing the amount of money an individual is willing to pay to maintain the same level of well-being for an improvement in health-related quality of life.

We use a sample of 11,007 respondents of the fourth wave of the Household, Income and Labour Dynamics in Australia (HILDA) collected in 2004. The sample contains information on self-reported well-being (also called happiness or life-satisfaction), income and health-related quality life. Health-related quality life is measured with the SF-6D, a popular instrument in the health economics literature. SF-6D is a cardinal measure of health and one stands for perfect health.

Results show that the mean health-related quality of life of the sample is 0.79 and the mean household income approximately 70,000 AUD per year. The econometric estimates show that an increase in health-related quality of life with 1% is associated with an increase in in well-being with 3.1%. Similarly an increase in income with 1% is associated with an increase in well-being of 0.05%. The relation between both health-related quality of life and income on the one hand and well-being on the other are non-linear. This implies that the marginal rate of substitution between income and health depends on the initial level of health. For instance, respondents are willing to pay almost 23,000 AUD for an improvement in health from 0.8 to 0.9 and from 68,000 for an improvement from 0.7 to 0.8.

.

Keywords: self-reported well-being, cost-benefit analysis, economic evaluations, health, valuation

1. Introduction

Rising health care costs are at the top of the policy agenda in most countries. In order to determine whether extra health care expenditures produce value for money it is necessary to determine the societal value of health. But also investments in other public policy domains like safety and environmental regulations might produce health. In order to determine their returns on investments knowledge about the societal value of health is necessary.

Economists generally derive the value of statistical lives from trade-offs people make between money and morbidity or morality risks; see Viscusi and Aldy (2003) for an extensive overview. The calculated monetary values of statistical lives can be used in standard cost-benefit analyses of public policies. In health economics it is proposed to use health-related quality of life measures as opposed to monetary value of statistical life measures. Health-related quality of life measures are cardinal measures of health: one is conventionally defined as perfect health and zero as dead (see Torrance (1986) for a discussion of various methods to value health and Dolan (2000) for an overviews). Consequently, cost-benefit analysis is converted into cost-utility analysis (Bleichrodt and Quiggin (1999) derive the conditions under which both are equivalent). Valuing health in cost-utility analysis is less controversial then in cost-benefit analysis. But the problem with cost-utility analysis is that in order to determine which programs are worth being implemented policy annalists still need to impute an implicit societal value of health/life. Gafni and Birch (2006) give an overview of adopted societal values of health in various countries. They also show that the adopted values often lack an empirical foundations.

This paper contributes to the literature by presenting a new way to calculate the societal willingness to pay for improvements in health-related quality of life. It uses the well-being valuation method. This method was introduced in the health economics literature by Ferrer-i-Carbonell and Van Praag (2002).

In this paper the well-being valuation method estimates the association between health-related quality of life and self reported well-being and between income and self reported well-being. Then we calculate the societal willingness to pay for improvements in health-related quality of life. This is done by keeping well-being constant and measuring the association between income and health. In economic terms the marginal rate of substitution between health and income is calculated by assessing the amount of money an individual is willing to pay to maintain the same level of well-being for an improvement in health-related quality of life.

In what follows, section 2 describes the well-being valuation method in more detail. First we describe the interview questions used; then the well-being model; and an explanation of the econometric methods. Section 3 gives the data and descriptive statistics. Section 4 presents the results for the well-being equation and Section 5 assesses the monetary value of health. Finally, Section 6 concludes and discusses the paper.

2. The well-being valuation method

2.1 Interview questions

The three main interview questions in this study are about well-being, health and income. In the interview, respondents are asked to indicate their own well-being by giving a number between 0 and 10 (Figure 1). Figure 1 was presented to the respondent by the interviewer on a show card.
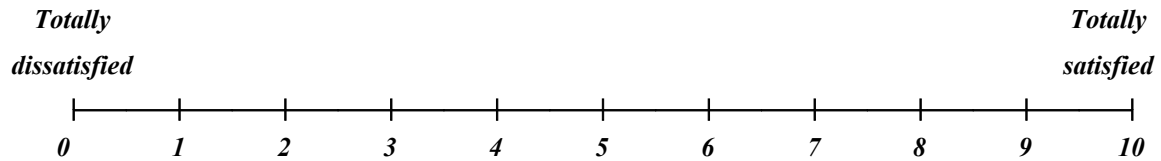
Totally dissatisfied   **Totally satisfied**

|—+—+—+—+—+—+—+—+—+—|

  0   1   2   3   4   5   6   7   8   9   10

Figure 1: Life satisfaction answer categories, scale 0 to 10

Answers to these (or similar) questions are usually referred to as an individual subjective well-being. The term used is often chosen independently of the exact formulation used in the questionnaire itself. In the subjective well-being literature the terms well-being, happiness, and satisfaction with life are used as interchangeable (see e.g. Blanchflower and Oswald (2004) and Van den Berg and Ferrer-i-Carbonell (2007)). Here we will use the term well-being. Exact phrasing of the survey question is presented in Figure 2.

Figure 1: Life satisfaction interview question

Respondents' health was measured by means of the SF-6D. The SF-6D was developed by Brazier et al. (2002). Figure 3 presents the exact SF-6D survey questions. See for a detailed description of the instrument Brazier et al. (2002) or Tsuchiya et al. (2006). Respondents have to indicate their health status according to list of functions. This is called theit descriptive health status. Next to the descriptive health states that are derived from various samples of the general population or patient populations, another representative sample of the general population values the various health states. The values are called Quality Adjusted Life Years (QALY's). A QALY score of one means living one year in perfect health whereas a QALY score of 0.5 means living one year in half health. QALY's are cardinal values of health-related quality of life and the SF-6D is a popular instrument to measure QALY's.

Physical Functioning
1 Your health does not limit you in vigorous activities
2 Your health limits you a little in vigorous activities
3 Your health limits you a little in moderate activities
4 Your health limits you a lot in moderate activities
5 Your health limits you a little in bathing and dressing
6 Your health limits you a lot in bathing and dressing

Role Limitations
1 Your have no problems with your work or other regular daily activities as a result of your physical health or any emotional problems
2 You are limited in the kind of work or other activities as a result of your physical health
3 Your accomplish less than you would like as a result of emotional problems
4 You are limited in the kind of work or other activities as a result of your physical health and accomplish less than you would like as a result of emotional problems

Social Functioning
1 Your health limits your social activities none of the time
2 Your health limits your social activities a little of the time
3 Your health limits your social activities some of the time
4 Your health limits your social activities most of the time
5 Your health limits your social activities all of the time

Pain
1 You have no pain
2 You have pain but it does not interfere with your normal work (both outside the home and housework)
3 You have pain that interferes with your normal work a little bit
4 You have pain that interferes with your normal work moderately
5 You have pain that interferes with your normal work quite a bit
6 You have pain that interferes with your normal work extremely

Mental Health
1 You feel tense or downhearted and low none of the time
2 You feel tense or downhearted and low a little of the time
3 You feel tense or downhearted and low some of the time
4 You feel tense or downhearted and low most of the time
5 You feel tense or downhearted and low all of the time

Vitality
1 Your have a lot of energy all of the time
2 Your have a lot of energy most of the time
3 Your have a lot of energy some of the time
4 Your have a lot of energy a little of the time
5 Your have a lot of energy none of the time

Figure 1: The SF-6D survey instrument adapted from Tsuchiya et al. (2006)

A third piece of information necessary to estimate the willingness to pay for health is respondent's income. The income question in the interview is with open answering categories. Exact income questions are presented in Figure 4.

<div style="border:1px solid #000; padding:10px;">

Do you know what your income from wages and salaries in this job is *after* tax and other deductions are taken out?

What was the total amount of your most recent pay *after* tax and other deductions?
Enter amount (whole $) $

And what period does that cover?
Week 1
Fortnight 2
Month...3
Year 4

</div>

Figure 4: Income question

The income question is thus asked on a continuous scale which is necessary to calculate the marginal rate of substitution between income and health.

2.2 The well-being model

Subjective questions on self-reported well-being have been used in economics to understand and explore a large range of interesting topics, such as unemployment, health, job situation, and income (see for overviews Frey and Stutzer (2002) and Van Praag and Ferrer-i-Carbonell (2004)). In doing so, economists take individuals answer to well-being questions as a proxy to measure utility (see, e.g. Frey and Stutzer (2002)). In other words, one of the main assumptions in the well-being literature is that the answer to the well-

being question is a monotonic positive transformation of theoretical concept we are interested in.

The first step of the present valuation method is to explain the well-being of the individual (W_i) by a set of objective variables. The following model is used to estimate W_i:

$$W_i = W(y_i, H_{i,} x_i) \qquad\qquad (1)$$

where y denotes the net family income of individual i, H is health measured valued with the SF-6D, and x is a vector of individual socio-economic and demographic variables. The vector x includes: gender, age, marital status, children, level of education, and occupation, Selection of variables is based on their expected direct effect on well-being, previous knowledge (existing literature in economics as well as psychology and sociology), intuition, and data availability.

Equation (1) postulates that individual's well-being associates, among other things, on income and on health. Both associations are expected to be positive. From equation (1) one can derive the existing trade-off between income and health for a given level of well-being. This trade-off is taken as the monetary value of health: an individual's willingness to pay for an improvement in health.

2.3 Econometric methods

In the subjective well-being literature, models of the type presented in equation (1) have been regressed with linear as well as with latent variable econometric techniques. The

first ones assume that the answers to well-being questions are cardinal, while the second type of techniques only assume ordinality. Ferrer-i-Carbonell and Frijters (2004) show that assuming cardinality or ordinality generates similar results in terms of the trade-offs between variables, which is the information we use in this paper. This paper regresses well-being (Figure 1) by means of an Ordered Probit (OP) and an Ordinary Least Squares (OLS) regression. OP takes respondent's well-being scores not as the exact level of well-being but as proxies. Moreover, OP implies that well-being scores are taken to be interpersonally comparable at an ordinal level, e.g. an individual answering a 4 has higher well-being than one answering a 2 but not necessarily twice as much well-being. But assumptions do not hold in OLS.

3. Data

We use a sample of 11,007 respondents of the fourth wave of the Household, Income and Labour Dynamics in Australia (HILDA). HILDA is a national representative sample of Australians collected in 2004. Watson and Wooden (2002) and (2004) give details of the survey development and data collection. Wooden and Watson (2007) give an overview of other applications of the data. Questions used in this study are answered in interviews.

Table 1: Frequencies of well-being

Well-being	Number of observations	Percent-age	Cumula-tive per-centage
0	17	0.2	0.2
1	14	0.1	0.3
2	47	0.4	0.7
3	79	0.7	1.4
4	141	1.3	2.7
5	427	3.9	6.6
6	638	5.8	12.4
7	1,988	18.1	30.4
8	3,611	32.8	63.3
9	2,469	22.4	85.7
10	1,576	14.3	100.0
Total	11,007	100	

Table 2 presents descriptive statistics of the other variables and also the mean well-being.

Table 2: Descriptive statistics

	Mean	SD	Min	Max
Well-being (0=totally dissatisfied to 10=totally satisfied)	7.96	1.50	0.00	10.00
SF-6D	0.79	0.12	0.29	1.00
Net household income (in AUD per year)	73,392.79	60,313.80	0.00	625,735.00
Male	0.47	0.50	0.00	1.00
Child(ren):				
Child(ren) live at home	0.38	0.49	0.00	1.00
Child(ren) live not at home	0.38	0.49	0.00	1.00
No children	0.33	0.47	0.00	1.00
Education (in years)	10.62	1.49	5.00	12.00
Marital status:				
Being married	0.60	0.48	0.00	1.00
Ever married	0.17	0.42	0.00	1.00
Never married	0.23	0.42	0.00	1.00
Occupation:				
Paid work full time	0.43	0.50	0.00	1.00
Paid work part time	0.21	0.41	0.00	1.00
Unemployed	0.03	0.18	0.00	1.00
Out of labour	0.33	0.47	0.00	1.00
Age (in years)	43.90	17.78	15.00	93.00
Number of observations	11,007			

It shows that the mean SF-6D scores of this population is 0.79 with a minimum 0f 0.29 and a maximum of 1 meaning perfect health. Mean household income per year is more then 70,000 AUD. Table 3 gives the distribution of SF-6D scores with the corresponding incomes.

Table 3: SF-6D categories with mean income

SF-6D	Frequency	Percentage	Mean SF-6D	Mean net household income (in AUD per year)
0.9 – 1	1,621	14.7	0.96	68813.14
0.8 - 0.9	3,869	35.2	0.84	60652.78
0.7 - 0.8	3,327	30.2	0.75	59163.22
0.6 - 0.7	1,352	12.3	0.66	51690.51
0.6 <	838	7.6	0.53	44236.38

4. Results

This section presents the estimation results for the two well-being equations: OP and OLS. Table 4 shows the econometric results.

Table 4: Regression results (dependent variable: well-being)

	OP		OLS	
Dependent variable: well-being	*Coefficient*	*z-value*	*Coefficient*	*t-value*
Ln (SF-6D)	2.198	29.310	3.095	28.250
Ln (net household income in AUD per year)	0.034	3.350	0.050	3.620
Male	-0.116	-5.380	-0.169	-5.820
Child(ren): [*]				
Child(ren) live at home	-0.065	-2.480	-0.091	-2.590
Child(ren) live not at home	0.015	0.470	-0.007	-0.160
Education in years	-0.063	-7.570	-0.069	-6.300
Marital status: [**]				
Married	0.343	10.090	0.506	10.540
Ever married	-0.047	-1.040	-0.100	-1.560
Occupation: [***]				
Paid work full time	-0.150	-4.900	-0.121	-2.920
Paid work part time	-0.038	-1.190	0.010	0.230
Unemployed	-0.204	-3.050	-0.260	-2.730
Age (in years)	-0.040	-10.180	-0.052	-10.100
Age*age (in years)	0.000	11.870	0.001	11.940
Intercept			9.685	48.580
Intercept term 1	-4.778			
Intercept term 2	-4.563			
Intercept term 3	-4.198			
Intercept term 4	-3.894			
Intercept term 5	-3.589			
Intercept term 6	-3.112			
Intercept term 7	-2.718			
Intercept term 8	-2.009			
Intercept term 9	-1.084			
Intercept term 10	-0.296			
Number of observations	11,007		11,007	
Pseudo R^2	0.05			
R^2			0.16	

[*]Reference group: no children.
[**]Reference group: never married.
[***]Reference group: out of labour.

As expected, in both equations there is a positive association between health and well-being and between income and well-being. Table 4 also shows that other variables are statistical significant: male, children at home, education, fill time paid work, and unemployed are negatively associated with well-being. Being married is positively associated with well-being.

5. Monetary value of health

In this section the results presented in Table 4 are used to calculate the monetary value of health. Table 5 present the results.

Table 5: Monetary values of health

SF-6D	OP	OLS
0.9 - 1	40,556	28,461
0.8 - 0.9	38,346	22,661
0.7 - 0.8	18,942	68,040
0.6 - 0.7	78,121	523,041
0.6 <	6,233,674	4,116,592

It shows that when respondents is higher their willingness to pay for better health decreases. This is consistent with standard marginal utility theory in economics.

6. Discussion and conclusion

This paper has shown that it is possible to find a monetary value of health based on the association between health and well-being and between income and well-being. The latter is measured by means of a self-reported well-being question. This method is called the well-being valuation method. It has been successfully applied in the health economics literature to calculate monetary compensations for a set of chronic diseases (Ferrer-i-Carbonell and Van Praag, 2002) and to calculate a monetary value of informal care (Van den Berg and Ferrer-i-Carbonell, 2007). The method is also used to measure e.g. the impact of aircraft noise (Van Praag and Baarsma, 2005).

Results show that the value of health decrease when respondent's health is better. This is consistent with standard marginal utility theory in economics. Our monetary values of health are similar to the ones used in the health economics literature (see e.g. Gafni and Birch (2006). However, the health economics literature often uses a constant value of health which is nor consistent with economic theory neither with our empirical findings.

Empirical results of the well-being valuation method show the usefulness of the method for the health economics literature in general and also for cost-benefit analysis of other public policy projects. The well-being valuation method is not superior to other valuation methods but a useful complement which gives an additional possibility to determine the convergent validity of the different valuation methods. An advantage of the well-being valuation method is that it might be cheaper to implement, as answering the well-being question requires less time and less survey space than answering the other valuation

questions. Moreover, there are already data available from large national surveys, such as the one used in this study: HILDA. These data could fill a gap in the current knowledge, especially when more detailed studies and questionnaires are lacking. The well-being valuation method gives the research community and policy makers a new, additional and flexible economic valuation instrument.

References

Blanchflower, D, Oswald, AJ. Well-being over time in Britain and the USA. Journal of Public Economics 88 (2004): 1359-1386.

Bleichrodt, H, Quiggin, J. Life cycle preferences over consumption and health: When is cost effectiveness analysis equivalent to cost benefit analysis? *Journal of Health Economics* 18 (1999): 681-708.

Brazier, J, Roberts, J, Deverill, M. The estimation of a preference-based measure of health from the SF-36. *Journal of Health Economics* 21 (2002): 271-292.

Dolan, P. The measurement of health-related quality of life for use in resource allocation decisions in health care. In Culyer, AJ, Newhouse, J. *Handbook of Health Economics* (2000): 1723-1760, Elsevier: North Holland.

Dolan, P, Olsen, JA, Menzel, P, Richardson, J. An inquiry into the different perspectives that can be used when eliciting preferences in health. *Health Economics* 12 (2003): 545–551.

Frey B, Stutzer A. What can economists learn from happiness research? *Journal of Economic Literature* 40 (2002): 402-435.

Ferrer-i-Carbonell A, Frijters P. How important is methodology for the estimates of the determinants of happiness? *Economic Journal* 114 (2004): 641-659.

Ferrer-i-Carbonell A, Van Praag BMS. The subjective costs of health losses due to chronic diseases. An alternative model for monetary appraisal. *Health Economics* 11 (2002): 709-722.

Gafni, A, Birch, S. Incremental cost-effectiveness ratios (ICERs): The silence of the lambdha. *Social Science & Medicine* 62 (2006): 2091-2100.

Torrance, GW. Measurement of health state utilities for economic appraisal: a review. Journal of Health Economics 5 (1986): 1-30.

Tsuchiya, A, Brazier, J, Roberts, J. Comparison of valuation methods used to generate the EQ-5D and the SF-6D value sets. *Journal of Health Economics* 25 (2006): 334-346.

Van den Berg, B, Ferrer-i-Carbonell, A, Monetary valuation of informal care: the well-being valuation method, *Health Economics* in press (2007).

Van Praag BMS, Baarsma BE. Using happiness surveys to value intangibles: The case of airport noise. *Economic Journal* 115 (2005): 224-246.

Van Praag BMS, Ferrer-i-Carbonell, A. *Happiness Quantified. A Satisfaction Calculus Approach*. Oxford University Press: Oxford, 2004.

Viscusi, WK, Aldy, JA. The value of a statistical life: A critical review of market estimates throughout the world. *Journal of Risk and Uncertainty* 27 (2003): 5-76.

Watson, N, Wooden, M. The Household, Income and Labour Dynamics in Australia (HILDA) Survey: Wave 1 Survey Methodology. *HILDA Project Technical Paper* 1/02 (2002). Melbourne Institute of Applied Economic and Social Research, University of Melbourne, Melbourne, Vic.

Watson, N, Wooden, M. The Household, Income and Labour Dynamics in Australia (HILDA) Survey: Wave 2 Survey Methodology. *HILDA Project Technical Paper* 1/04 (2004). Melbourne Institute of Applied Economic and Social Research, University of Melbourne, Melbourne, Vic.

Wooden, M, Watson, N. The HILDA Survey and its contribution to economic and social research (so far). *Economic record* 83 (2007): 208-231.