Eur J Health Econ (2014) 15:787–790
DOI 10.1007/s10198-014-0618-0

EDITORIAL

Considering productivity loss in cost-effectiveness analysis: a new approach

Afschin Gandjour

Published online: 2 July 2014

Introduction

Cost-effectiveness analysis in health care can adopt different viewpoints, e.g., that of a payer or society. When a societal viewpoint is adopted, the analysis should include productivity costs due to illness [3]. According to the definition of the US Panel on Cost-effectiveness in Health and Medicine [6] productivity costs are "(1) the costs associated with lost or impaired ability to work or to engage in leisure activities due to morbidity and (2) lost economic productivity due to death". Debate is going on about how to consider productivity loss from time off work when quality-adjusted life years (QALYs)[1] are used as a measure of effectiveness. For example, the US Panel on Cost-effectiveness in Health and Medicine [11] suggested excluding lost income from the numerator of the incremental cost-effectiveness ratio (ICER), assuming that respondents to health state valuation exercises take income changes into account. Otherwise, double counting of productivity costs would occur. Yet, income loss may be small in countries where paid sick leave schemes exist [10]. Furthermore, a recent review on empirical evidence for the consideration of income loss in direct preference-based measures in the United States and other countries concluded that "not explicitly mentioning the inclusion of income will induce a minority of respondents to include these effects and this appears not to influence results" [10]. A very recent large-sample survey in the general population of Japan confirmed this finding. It showed that there was an insignificant difference in SG and TTO scores between no instruction regarding income and explicit instruction not to consider income reduction [9]. Based on these studies double counting of productivity costs seems negligible.

A related line of empirical research has dealt with the question whether respondents consider the effects of ill health on leisure and how much this matters. Brouwer et al. [2] showed that a larger percentage of respondents considered the effects of ill health on leisure than on income and that the effects of ill health on leisure proved to be influential on VAS measurements. Yet, as the effects on leisure were not systematically considered, the authors remain careful in recommending the explicit incorporation of leisure effects in health state valuation exercises and suggest additional research [2].

A recent theoretical analysis by Nyman [8] arrives at the same conclusion in terms of considering leisure time and income effects. Nyman's rationale is that questionnaires which elicit health state utility values do not capture income effects in a consistent way. Furthermore, he suggests that health state valuation exercises do capture the impact of absence from work on leisure time activities (i.e., there may be an increase in leisure time). Specifically, he refers to the multidimensional (indirect) preference-based measures EQ-5D, SF-6D, and quality of wellbeing index as these include a dimension on role functioning, which is also a measure of leisure time activities. Accordingly,

A. Gandjour (✉)
Frankfurt School of Finance and Management,
Sonnemannstr. 9-11, 60314 Frankfurt am Main, Germany
e-mail: a.gandjour@fs.de

[1] QALYs are the product of life years and a representation of preference for different health states (preference weight or score). Techniques to obtain preferences include direct preference-based measures such as the time trade-off (TTO) method, the standard gamble (SG) method, or visual analogue scales (VAS). In addition, there are multidimensional (indirect) preference-based measures such as the EuroQol (EQ)-5D, which translate dimensional scores into a single preference weight.

Nyman holds the principle that when a multidimensional questionnaire explicitly includes a dimension affected by absence from work (in this case role functioning as a measure of leisure time activities), then the impact of absence from work on this dimension is (consistently) captured. That is, what matters for considering income effects in the numerator of the ICER is the *potential* of QALYs to capture these income effects. This is different from the previous empirical studies which relate to the *sensitivity* of QALYs to capture income effects.

The purpose of this editorial is to present a novel theoretical argument ('consistency argument') with regard to consideration of productivity loss in cost-effectiveness analysis. It will be discussed along the above mentioned potentiality and sensitivity arguments. As will be explained, disagreement between the arguments only refers to the effect of income on the individual and not on the rest of society. That is, an individual who works makes contributions to the consumption of others by tax payments, social insurance payments, or donations. All three arguments suggest that this portion of an individual's (gross) income should be incorporated in the numerator of the ICER. This was also recommended by the US Panel [11].

Potentiality argument

In the following, I take Nyman's potentiality argument to argue that multidimensional questionnaires do not only capture the impact of absence from work on leisure time activities but also the impact of absence from work on income. To explain, consider that income influences utility essentially in two ways. The first is by having an impact on leisure time activities. That is, a loss of income due to ill health may lead to a change in leisure time activities from more expensive to less expensive activities. Following Nyman, such changes would be captured by multidimensional questionnaires (although Nyman does not refer to the impact of income changes on leisure time but to the impact of absence from work on leisure time). Second, income influences utility in a direct way. A gain in income makes people a little happier (e.g., Dynan and Ravina [4]) while a loss of income may lead to unhappiness, fears about the future, and ultimately depression (e.g., Kessler et al. [5]). In this regard, even a small income loss can be very painful for a household living on the edge. As mental states are captured by questionnaires to elicit health state utilities, the direct impact of income on utility is potentially captured too. For example, the EQ-5D asks respondents whether they are anxious or depressed. That is, if we apply Nyman's principle that multidimensional questionnaires must explicitly include an affected dimension, then the impact of income is captured. One may argue that health state valuations do not necessarily capture an increase in income-related happiness. However, when measuring the impact of income on health we are concerned about the downside, i.e., income loss. Income loss, in turn, can be captured through its impact on mental states, i.e., there is a potential for capturing income loss.

It is important to note that the potentiality argument itself does not require empirical evidence. Yet, one may argue that having the potential to pick up leisure time and income changes does not mean that this actually happens. That is, one may argue that empirical evidence for sensitivity is more important than potentiality. The issue of sensitivity is discussed in the following section.

Sensitivity argument

The sensitivity argument suggests including productivity costs in the numerator of the ICER because QALYs are not sensitive enough to pick up income-related changes in utility. Yet, the issue of sensitivity of QALYs arises not only with respect to income and leisure time effects but also with respect to quality of life as such, e.g., in acute diseases of short duration. A major question is how to define a threshold for when QALYs are sensitive and when they are not. Currently, this threshold is defined rather arbitrarily. Statistical significance might be a potential solution but is affected by the size of the sample. In any case, it is important to note that there should be consistency in defining when QALYs are sufficiently sensitive, in terms of income, leisure time, and quality of life.

When QALYs are not sufficiently sensitive to pick up subtle changes in quality of life, it has been suggested to use condition-specific questionnaires and map them onto generic preference-based indexes [12]. Thus, preference scores can be estimated using the disease-specific measures. Hence, lack of sensitivity of QALYs is corrected in the denominator of the ICER (and not in the numerator as suggested for income).

If we take the sensitivity argument to its extreme, a lack of sensitivity justifies using condition-specific questionnaires whenever QALYs or a specific dimension of an indirect preference-based measure are not sensitive. At the minimum this introduces considerable uncertainty into the measurement of QALYs as the mapping algorithms are subject to uncertainty.

Consistency argument

When there are payments for sick leave, a negative impact of income loss on health state valuations will be attenuated and may actually become zero. This does not mean,

however, that income has no effect on health state utilities but that its effect is masked by payments for sick leave. That is, even if respondents to a health state valuation exercise say that they do not consider income changes, they implicitly do so because of the sick leave payment. Hence, the benefit of payments for sick leave is well captured in the denominator. For consistency reasons the cost of payments for sick leave need to be included as well (in the numerator of the ICER). Hence, the numerator of the ICER should not only include the loss of contribution to the rest of society due to sickness (or the corresponding increase in contribution due to treatment) but also the cost of payments for sick leave (or the corresponding reduction due to treatment). Accidentally, the underlying principle of including costs "if they represent resources that directly produce the utility that is being measured in the denominator of the cost-utility ratio" was published by Nyman several years ago [7].

One may argue that the utility gain of payment recipients is exactly offset by the utility loss of those who make the payment. That is, the cost of payment would be captured as a disutility of those who make the payment. However, there is currently no evidence that this holds. Furthermore, we would need to ask respondents to health state valuation exercises to exclude income changes. However, this is a strictly theoretical exercise as respondents do not know how they would feel without payment for sick leave. As patients without such payment have an increased probability of becoming depressed (e.g., Kessler et al. [5]), one needs to assess the rate and severity of depression as a consequence of no payment. Respondents might be able to convey their emotional reaction and say how sad they would become, but they have no basis for predicting depression. Contrary to the common misconception that depression means sadness, the symptoms of depression go beyond mere sadness, and the person may feel empty and lose interest in all activities most of the day [1]. Patient ratings that exclude sick leave payments are therefore arbitrary.

Furthermore, one may argue that payments for sick leave are transfer payments and therefore should be ruled out from a societal perspective. However, there is an actual resource consumption associated with the transfer payment. That is, the impact of income loss on health state valuations is attenuated exactly because the person in question is able to continue his or her consumption. This resource consumption is approximated by the transfer payment. Transfer payments may also include a portion that is not used for resource consumption but for personal savings and/or donations. This portion may not need to be excluded or subtracted, however, because it may also contribute to the QALY gain by its influence on mental states. Proponents of the sensitivity argument may argue that this needs to be shown empirically; however, the situation where respondents imagine not using transfer payments for savings and/or donations seems again highly artificial.

Final notes

I found the potentiality argument by Nyman [8] to be innovative and inspiring, but thinking it through to the end actually supports the position that effects of income on health can be consistently captured by multidimensional questionnaires in the denominator of the ICER.

The consistency argument provided in this editorial suggests including the costs of continued salary payments in the numerator, however. In countries with generous continued salary payments during sick leave the consistency argument therefore arrives at a similar conclusion as the sensitivity argument. In countries where continued pay is 100 % of the salary, there is actually no difference between the two arguments (i.e., productivity costs are fully considered in the numerator of the ICER).

For countries without generous salary payments during sick leave, the potentiality and consistency arguments justify the inclusion of major portions of income changes in the denominator. The sensitivity argument suggests otherwise but currently suffers from an insufficient operationalization of what is a sensitive preference-based measure.

As a word of caution, the potentiality argument does not hold for direct preference-based measures such as the SG, TTO, and VAS methods. Both the sensitivity and the consistency argument, however, hold for direct measures too.

I hope that this editorial advances the debate about consideration of productivity loss in cost-effectiveness analysis. Those who object to the consistency argument need to show that the utility gain of payment recipients is exactly offset by the utility loss of those who make the payment. But even then the problem remains that ruling out income changes from the utility responses is a strictly theoretical exercise. For future research I recommend operationalization of what is a sensitive preference-based measure. In any case, for countries with generous sick leave pay this will not lead to a fundamentally different conclusion than provided by the consistency argument.

Conflict of interest There are no potential conflicts of interest.

References

1. American Psychiatric Association: Diagnostic and statistical manual of mental disorders, 4th edn. American Psychiatric Association, Washington, DC (1994)

2. Brouwer, W.B., Grootenboer, S., Sendi, P.: The incorporation of income and leisure in health state valuations when the measure is silent: an empirical inquiry into the sound of silence. Med. Decis. Mak. **29**(4), 503–512 (2009)
3. Drummond, M.F., O'Brien, B.J., Stoddart, G.L., Torrance, G.W.: Methods for the economic evaluation of health care programmes, 2nd edn. Oxford Medical Publications, Oxford (1997)
4. Dynan, K.E., Ravina, E.: Increasing income inequality, external habits, and self-reported happiness. Am. Econ. Rev. **97**(2), 226–231 (2007)
5. Kessler, R.C., Turner, J.B., House, J.S.: Intervening processes in the relationship between unemployment and health. Psychol. Med. **17**(4), 949–961 (1987)
6. Luce, B.R., Manning, W.G., Siegel, J.E., Lipscomb, J.: Estimating costs in cost-effectiveness analysis. In: Gold, M.R., Siegel, J.E., Russell, L.B., Weinstein, M.C. (eds.) Cost-effectiveness in Health and Medicine. Oxford University Press, New York (1996)
7. Nyman, J.A.: Should the consumption of survivors be included as a cost in cost-utility analysis? Health Econ. **13**(5), 417–427 (2004)
8. Nyman, J.A.: Productivity costs revisited: toward a new US policy. Health Econ. **21**, 1387–1401 (2012)
9. Shiroiwa, T., Fukuda, T., Ikeda, S., Shimozuma, K.: QALY and productivity loss: empirical evidence for "double counting". Value Health **16**(4), 581–587 (2013)
10. Tilling, C., Krol, M., Tsuchiya, A., Brazier, J., Brouwer, W.: In or out? Income losses in health state valuations: a review. Value Health **13**(2), 298–305 (2010)
11. Weinstein, M.C., Siegel, J.E., Gold, M.R., Kamlet, M.S., Russell, L.B.: Recommendations of the panel on cost-effectiveness in health and medicine. JAMA **276**(15), 1253–1258 (1996)
12. Xie, F., Pullenayegum, E.M., Li, S.C., Hopkins, R., Thumboo, J., Lo, N.N.: Use of a disease-specific instrument in economic evaluations: mapping WOMAC onto the EQ-5D utility index. Value Health **13**(8), 873–878 (2010)