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On the welfare theoretic foundation of CEA: comment

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Abstract This is a comment on a recent paper by Bengt Liljas (Eur J Health Econ 11:5–13, 2010) in this Journal. The author's analysis is flawed because he fails to take the envelope theorem into account. As a bottom line, we conclude that from a welfare theoretic point of view, future consumption and future labor hours should not be considered in a valid CEA.

Keywords QALYs · Cost-effectiveness analysis · Non-medical costs

JEL classification D61 · D81 · I10

In a recent contribution to this journal, Liljas [1] analyzes whether changes in consumption and leisure should be included on the cost side and/or on the utility side of a cost-per-QALY assessment of new health care technologies. The analysis is based on a model of a utility maximizing consumer, and the results are based on an examination of the first-order condition of this maximization problem with respect to health care utilization. A peculiar feature of the algebraic analysis by the author is that he takes behavioral reactions of the decision maker to changes in health into account and thus inserts a "consumption function" and a "leisure choice function" into the utility function, which is to be maximized. As a consequence, changing the consumption of medical services has a considerable number of indirect effects on the person's utility—through his altered consumption and labor supply behavior. This procedure is inconsistent with microeconomic theory. In particular, the Envelope Theorem implies that at the optimum, the sum of all these indirect effects must be zero so that the answer to the initial question by the authors is trivial: neither changes in consumption nor changes in labor supply should be considered in a cost-per-QALY assessment.

To make my point, I will present the correct welfare economic model. Without loss of generality, I will ignore the time dimension of the problem. Given that survival is assumed to be not affected and thus the time horizon is fixed, this simplification is innocuous. Therefore, we consider the static model of choosing consumption c, leisure l, and medical care consumption m optimally so as to maximize the utility function $U(c, l, h)$, where $h = h(m)$ is the health production function, subject to the budget constraint

$$c + q \cdot m = (1 - l) \cdot w[h(m)]. \tag{1}$$

For convenience, the only consumption good is used as a numéraire so that the Lagrange multiplier λ of the appropriate maximization problem can be interpreted directly as marginal utility of income: Thus, the Lagrangean reads:

$$\Phi(c,l,m) = U[c,l,h(m)] + \lambda \cdot \{(1-l) \cdot w[h(m)] - c - q \cdot m\} \tag{2}$$

and the first-order conditions are as follows:

$$U_c - \lambda = 0 \tag{3}$$

$$U_l - \lambda \cdot w = 0 \tag{4}$$

$$U_h \cdot h' + \lambda \cdot [w' \cdot h' \cdot (1 - l) - q] = 0 \tag{5}$$

and thus by inserting Eq. 3 into Eq. 5 and rearranging terms, the correct expression for the cost-per-QALY ratio becomes

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$$\frac{q - h' \cdot (1 - l) \cdot w'}{U_h \cdot h'} = \frac{1}{\lambda} \tag{6}$$

instead of the much more complicated formula in Eq. 4 of Liljas [1, p. 7]. The denominator of Eq. 6 measures the marginal utility of a unit of medical care, and the numerator measures the net marginal costs that are composed of direct costs q minus the monetary gain from the increased productivity. Thus, the LHS measures the cost-per-QALY, which has to be equal to the inverse of the marginal utility of income (RHS). Unlike in Liljas' complicated equation, changes in hours of work and in consumption do not appear in this formula because whenever these variables are optimally chosen, their marginal effect on utility must be zero.

Hence, changes in future consumption and in future labor supply do not belong to a proper CEA, at least from a welfare economic point of view.

References

1. Liljas, B.: On the welfare theoretic foundation of cost-effectiveness analysis—the case when survival is not affected. Eur. J. Health Econ. **11**, 5–13 (2010)