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Contingent Valuation Surveys and Cost-benefit Analyses

An application for a prevention programme for hand eczema*

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Abstract

This paper provides a discussion and an analysis of some of the critical aspects when conducting a cost-benefit analysis of a health care programme based on a contingent valuation survey. In particular, we focus on how to elicit willingness to pay into a contingent valuation survey in order to provide the necessary information for identifying all components in a cost-benefit analysis. We also look at how the components in a cost-benefit analysis should be aggregated in order to study whether or not a programme is socially desirable. These issues are illustrated and discussed by using a hand eczema prevention programme as an empirical example.

Zusammenfassung

Dieser Aufsatz untersucht die Diskussion und Analyse von kritischen Aspekten bei der Durchführung einer Kosten-Nutzen-Analyse des Gesundheitsvorsorge-Programms mit Hilfe einer „kontingenten Evaluierungsmethode“. Der Hauptfokus unserer Untersuchung liegt darin, wie eine Bereitschaft ausgelöst werden könnte, in eine „kontingente Evaluierungsmethode“ zu investieren, um die nötige Information für die Identifizierung aller Komponenten einer Kosten-Nutzen-Analyse zum erhalten. Außerdem untersuchen wir das Problem der Aggregation der Komponenten einer Kosten-Nutzen-Analyse, wenn untersucht werden soll, inwiefern ein Programm sozial wünschenswert ist. Diese Fragestellungen werden anhand des empirischen Beispiels eines Handekzem-Präventionsprogramms illustriert und diskutiert.

JEL Classification: I 10

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1. Introduction

Despite the importance of ensuring efficient allocation of resources, cost-benefit analyses (CBA) are not usually conducted in the evaluation of health care programmes, although CBA is firmly rooted in microeconomic theory and welfare economics (see e.g. Kenkel, 1997). The main reason for this may be that changes in health status are difficult to value in monetary terms. However, according to Weinstein and Manning (1997), it is also because decision-makers may prefer to measure the outcome of a programme in physical rather than monetary units where the ability to pay may influence the outcome of the analysis. Thus, as indicated, cost-effectiveness analysis and cost-utility analysis have often been applied to evaluate health care programmes.[1] The main difference between a CBA and a cost-effectiveness analysis is that the latter measures the benefits of the programme in some form of physical unit, e.g. the number of avoided heart attacks rather than in monetary units. A cost-utility analysis, on the other hand, measures the benefits of a programme in some form of standardised physical unit such as the quality adjusted life years (QALYs) or healthy years equivalent (HYEs) (see e.g. Gold et al, 1996). The inherent problems associated with ranking programmes with cost-effectiveness analysis, due to deflating costs with the physical units gained, can be solved by using a cost-utility analysis because health improvements are measured with a health status index that by definition allows for comparison between different types of illnesses. However, neither cost-utility analysis nor cost-effectiveness analysis can be a yardstick when determining whether a programme is desirable from a societal perspective in competition with non-health care programmes since the various effects are not measured in a common unit.

Over the last decade, stated preference methods have increasingly been applied to the monetary valuation of health improvements. Furthermore, contingent valuation (CV) is the main technique used in this process (see e.g. Diener et al, 1998, Johannesson, 1996, Olsen and Smith, 2001, for overviews). CV-technique is a survey-based method that is most commonly used to elicit individuals' valuations of a health care programme. A CV-survey is conducted in such a way that a scenario describing the health care programme under consideration and its effects, is first presented to the respondents, then a valuation question is posed in order to elicit their willingness to pay (WTP) for realising the scenario presented.

In order to obtain the net present value of a programme, i.e. to finalise the CBA, the results from a CV-survey need to be first combined with the costs and the cost savings that the programme has generated for the government and then all these items must be aggregated. Thus, a complementary exercise for

[1] See e.g. Drummond et al. (1999) for an overview on these analytical approaches.

the CV-survey is to identify and value the components that should be included in a CBA but have not been considered in the respondents' stated WTP. It should be noted that this is a crucial exercise if a correct and meaningful CBA is to be conducted. Finally, a CBA requires aggregation of the collected data in order to judge whether or not a programme is socially desirable. In the literature of public economics there is debate over whether or not to use distributional weights in a CBA, i.e. whether weights should be imposed when converting individuals' changes in welfare to their social equivalents (see e.g. Dreze and Stern, 1987, and e.g. Johansson, 1995, for a discussion in the context of health economics). However, on a practical level, distributional issues are rarely addressed in a CBA. It should also be noted that aggregation without imposing any distributional weights implicitly assumes equal weights are given to all individuals. An approach that finds a compromise to the issue of using distributional weights is one that reports costs and benefits from a programme at a disaggregated level by using suitable sub-groups. This approach would then allow the reader to test how the outcome of the programme is affected by using different weights explicitly. This can also be seen as a sensitivity analysis.

Discussions about the way a CBA should be applied in health economics are necessary and important. The theoretical foundation is well established for CBA, but several items such as methodological issues when using CV-surveys, how to include additional costs and cost savings, and finally how to consider distributional aspects in the aggregation, need further research. The objective of this paper is to discuss how to conduct a CBA for a health care programme when part of the input is based on a CV-survey. We illustrate our discussion about how to estimate, evaluate and incorporate the issues discussed in order to arrive at a final CBA, by using a secondary hand eczema prevention programme in Sweden as an example. This prevention programme is not currently available for individuals in Sweden. It should be noted that tests of methodological issues when applying a CV-survey per se is outside the scope of this paper.[2] The rest of the paper is organised as follows. In Section 2 we discuss empirical issues that need to be considered when performing a CBA that uses results from a CV-survey and in Section 3 we present our empirical application of a CBA to a prevention programme on hand eczema in Sweden. Section 4 contains our analysis of the CV-survey and a discussion and aggregation of the different components in order to finalise our CBA. Finally, in Section 5, we conclude the paper.

[2] For a general discussion on potential bias in a CV-survey see e.g. Diamond and Hausman (1994), Hausman (1993) and Mitchell and Carson (1989).

2. Empirical considerations in a cost-benefit analysis

There are three main empirical areas to consider when employing a CBA in the economic evaluation of a health care programme. First, the health improvement must be measured in monetary terms and we consider the application of a CV-survey as already mentioned. As is always the case when using survey instruments, this demands careful implementation and performance. Second, we must identify other effects of the programme that are not included in the elicited WTP. Finally, each individual's WTP and other net cost savings as a result of the programme must be aggregated in order to be able to evaluate the programme on a social level.

The monetary value that individuals place on the effects of the health care programme is estimated by using a CV question. There are two different formats to choose from; closed- and open-ended. In a closed-ended format the respondents are asked whether they would be willing to pay a certain amount, a bid, in order to realise the described scenario whereas in an open-ended approach, individuals are asked to state their maximum WTP. In open-ended applications in Sweden, which has a public health care system with fixed patient fees, it has been found that a large proportion of the stated WTP closely coincides with the prevailing co-payment, which could be interpreted as an anchoring effect. In a similar manner, the problem of anchoring was not found in the closed-ended approach (e.g. Johannesson, 1996).

A closed-ended CV-survey has its theoretical basis in random utility theory. According to random utility theory, the utility for individual i, u_i, is assumed to comprise a systematic component and a random component, ε, where the former relates to the measurable component of utility while the latter captures the effect of unobserved and / or omitted effects. Thus this results in

$$u_{ij} = u_{ij}(h_j, y_i, S_i, \varepsilon_{ij}) \ , \tag{1}$$

where h_j is the health programme j, y is income and S is a vector of the personal characteristics of respondent i. Respondent i will choose programme k at a cost of B, i.e. the bid presented in the closed-ended CV-survey, in preference to no programme if $u_{ik} \geq u_{i0}$. This can be expressed as the probability of individual i choosing health care programme k, which corresponds to

$$P_{ik} = \Pr(u_{ik} \geq u_{i0}) = P_r\big(u_{ik}(h_k, y_i, B, S_i, \varepsilon_{ik}) \geq u_{i0}(h_0, y_i, S_i, \varepsilon_{i0})\big) \ . \tag{2}$$

However, participation in health care programmes is, in most cases, voluntary, thus those individuals who would derive disutility from participation in the programme, even though the programme would be offered for free, will choose not to participate, i.e. a corner solution in a traditional demand model framework. Since individuals who derive disutility from participation can opt

out, their WTP to be included in the CBA for the programme is zero. This results in a demand function consisting of two parts; (i) a vertical part at WTP equals zero describing non-participants, and (ii) a continuous part for positive values of WTP elicited from participants. Thus, the sample can be divided into a proportion of non-participants with a WTP equal to zero and a proportion of participants with a positive WTP. These two parts can be seen to represent two decisions; a participation decision and a valuation decision conditional on participation. Two-part models have been discussed frequently in e.g. demand for consumer goods, especially durable goods, (e.g. Hanemann, 1984), and in recent years in the demand for health care, which have been modelled by separate specifications for the participation decision and the volume decision respectively (see e.g. Jones, 2000, for an overview). Our case is similar and thus we apply a two-part model when modelling the demand for the health care programme. In the two-part model, the first binary decision on whether or not to participate can be estimated by e.g. using a probit or a logit model. In the second stage, the demand for the programme conditional on participation is analysed by estimating whether or not the participants are willing to pay the bid presented as a function of the size of the bid and other covariates.[3] In a CV context, Hanemann and Kanninen (1999) and Kriström (1997) have discussed two-part models for environmental goods.[4] To estimate the model presented in equation (2), specification of both the distribution of the error terms and a functional form of the measurable part of the utility function are required. A commonly applied approach to model non-negative WTP is to use the framework suggested by Bishop and Heberlein (1979), which was proved to be consistent with random utility theory by Hanemann and Kaninnen (1999). Let us denote the vector of exogenous variables as X, which includes the variable health programme, h_j, and personal characteristics of the respondent i, S_i, and a vector of the unknown parameters to be estimated, β. We restrict WTP to positive values by following the approach in the Bishop and Heberlein paper, i.e. to calculate the logarithm of the bid. This is then entered as an explanatory variable. Moreover we specify the measurable part of the utility as being linear in parameters. Under the assumption that the difference in the error terms of a linear functional form of equation (2) is normally distributed, the probability of answering 'yes' to being willing to pay the presented bid or not in a closed-ended CV questions can be expressed as

$$\Pr(\textit{'yes'}) = \Phi(\alpha + \gamma \ln B + \beta X_i) \ . \tag{3}$$

[3] Furthermore, there may be correlation between the two models, in which case a probit model with sample selection can be applied to allow for this (see e.g. van de Ven and van Praag, 1981).

[4] In Kriström (1997) two types of spike models were considered, the zero spike model and the extended spike model. The zero spike model is what we, in this paper, describe as the spike model.

It should be noted that, as with all binary choice models that are linear in parameters, the explanatory variables that do not vary between the alternatives by definition cancel each other out. Thus, inclusion of personal characteristics, as in equation (3) above, should be interpreted as shifts in the probability of answering "yes" related to the personal characteristics of the respondents and the same interpretation holds for income.

Calculation of the welfare measure should then be based both on the probability of participation and the estimated WTP conditional on participation, where the mean *WTP* is calculated as

$$\hat{WTP} = \frac{1}{n}\sum_{i=1}^{n} \hat{WTP}_i = \frac{1}{n}\sum_{i=1}^{n} \hat{p}_i e^{\left((\alpha+\beta X_i)/\gamma\right)} e^{(1/2\gamma^2)} , \tag{4}$$

where $\hat{p}_i$ is the predicted probability of individual *i*to participate based on the estimation of a binary choice model of participation (see e.g. Hanemann and Kanninen, 1999).

Normally, non-participants cannot be identified from data collected in closed-ended CV-surveys, since the only information elicited is whether or not an individual's WTP exceeds the bid presented. But, in order to model non-participants, we need to identify them. Two identification approaches have been suggested in the literature. In Kriström (1997) respondents are first asked whether they are willing to pay anything for an environmental programme and then the valuation question is posed to those respondents who indicate a positive WTP. Another approach is to follow up 'no' answers to a valuation question in order to identify non-participants. This is applied in Johannesson et al. (1998) in a CV-survey on WTP for reduced waiting time for a health treatment by purchasing insurance. Previous research has indicated that when a closed-ended valuation question is followed-up by a second valuation question, it may result in a starting point bias (e.g. Green et al., 1998, and Kartman et al., 1997). Thus, it may be undesirable to ask a sequence of valuation questions. One approach that avoids asking two valuation questions in a row is first to ask a qualitative question about the programme, without stressing monetary values, in order to identify participants and then to follow it with a valuation question to those individuals who have been identified as participants. Essentially, the first question would then only focus on whether the respondents derive utility or disutility from the programme offered. We consider this to be a better alternative than the reversed order, where the valuation question is asked first. In such a case the answer to the participation question is more likely to be anchored on the bid presented as respondents may consider the bid to be related to the efficiency and / or cost of a programme, which then may affect the probability of being classified as a non-demander of the programme.

In addition to what is included in the elicited WTP, all other effects caused by the programme must also be estimated. On the cost side of the CBA is the cost of the programme per se such as wages, use of medical instruments, rent etc. The cost savings (or the benefits) of the programme for the government is lowered utilisation of health care, both in number of visits and amount of pharmaceuticals used. A potential important effect of a health care programme is reduced absenteeism from work, which would reduce the losses of production and productivity for society. The human capital approach has been frequently applied in the estimation of these losses. This is based on gross wages and is also implicitly based on the assumption that gross wages equal the marginal product of labour. However, there are alternative suggestions in the literature, e.g. by Drummond (1992), that this would result in an overestimation of actual loss due to replacement of the absent individuals. Koopmanschap et al (1995) coined the friction cost approach, which concentrates on the costs incurred before production is back to its original level. It is clear from the above that it is important to trace what the respondents have included in their stated WTP in order to avoid either missing out items or counting them twice. Thus if, for example, some cost savings, such as reduced absence from work are not considered in the elicited WTP from the respondents and not added separately, then the net present value reported of a programme is biased downwards. These issues will be discussed in more depth when we describe the design of our survey in the following section.

A crucial step in a CBA is the aggregation of the different components in order to study whether or not the programme is socially desirable. A very strict yardstick is, of course, the Pareto principle, where the programme is desirable only if it results in at least one person who gains from it and no one is made worse-off. The evaluation by using a CBA is based on weaker assumptions. The net social welfare from the programme consists of the total change in WTP and net government revenues. The change in welfare from a programme j, if we ignore the change in net government revenues, can then be expressed as: $dW = \sum_i \frac{\partial W}{\partial u_i} \frac{\partial u_i}{\partial y_i} WTP_{ij}$, where Wdefines social welfare. In this expression there are two partial derivatives: first the welfare weight to be given to individual i and second the marginal utility of income for individual i, which together represent social marginal utility of income. If distributional weights are going to be included explicitly in a CBA, these must be specified. A problem of using weights is, of course, to find and justify appropriate weights to apply. There are two main ways to derive these weights, (i) a priori determined weights or (ii) revealed weights from past decisions. Squire and van der Tak (1975) provides an example of how to use distributional weights according to policy objectives from a purely efficiency-orientated CBA in which the distributional weight of one is attached to all individuals to a Rawlsian approach where all of the weight is given to the worst off individuals. Another approach could be

to estimate the implicit weights that have been used in previous public decisions in order to accept or reject the projects under discussion (see e.g. Brent, 1996). The argument for not including weights at all in a CBA is that the objective of a CBA is solely to identify efficient programmes and that income can be redistributed through taxation (see e.g. Harberger, 1980). A more pragmatic approach is to report costs and benefits from a programme in suitable sub-groups. In this case the results of placing different weights on the outcome can be explicitly tested by the reader. Independent of the approach applied in the aggregation of the components, it is important to show the outcomes at a disaggregated level so that the reader can perform a sensitivity analysis. The other thing to consider in the CBA is the net government revenue. The prevention programme may have an effect on public funds either because additional funds may have to be raised through tax or vice versa. In the cost-benefit literature there is debate about whether and how to include marginal excess burden into the CBA. The work by Boadway and Keen (1993), Christiansen (1981) and Kaplow (1996) indicates that the idea of correcting for marginal excess burden in a general setting with many non-identical consumers and an optimal non-linear income tax in public investments can be questioned and thus we argue that in general we should not correct for excess burden.

3. Design of the empirical application

The prevention programme that we use in our empirical application is designed to target individuals currently suffering from hand eczema. Hand eczema is a common disease in Sweden and also the most prevalent occupational skin disease. In Sweden the 1-year prevalence of hand eczema is about 10% of the population aged between 20 and 65 and is highest amongst young females (Meding, 1990). The most frequent type of hand eczema is irritant contact dermatitis caused by exposure of the skin to irritants like water and detergents. Allergic contact dermatitis is also common and more than 3700 substances have been identified as causes of contact allergy (de Groot, 1994). The duration of hand eczema is often long, but in the majority of cases there are symptom free periods (Meding, 1990). As external exposure is of importance in causing the symptoms, measures aimed at reducing exposure are suitable preventive tools. Due to individual differences, prevention activities at an individual level are necessary. The possibility of improving future levels of hand eczema is related to proper knowledge of the causes of the disease and identification of possible contact allergies. Thus, we consider a prevention programme, which contains a clinical examination performed by an experienced occupational dermatologist including patch testing to diagnose contact allergy, prescriptions and recommended treatments for the hand eczema and personal advice on protective measures e.g. skin care and protective gloves at work and

at home. In addition, the programme also includes a follow-up visit to determine whether there is a need for additional measures.

It is important in a CV-survey to specify both the entitlement to and the financing of the programme in the scenario. In order to make the scenario realistic we presented the secondary prevention programme of hand eczema described above as being possible to offer today but not currently available on demand. We used both focus groups and pilot tests in order to develop the CV-survey and the wording of the scenario is presented in Appendix. As discussed in the previous section, it is important to identify the respondents who are not willing to pay anything for the programme, i.e. those to be identified as non-participants. We argued in Section 2 that the sequence of questions to be asked should be first to identify participants and then to ask if they are willing to pay a certain amount for realising the programme since this may reduce the anchoring effect on the bid, which could be a problem with the reversed order. In our case, we ask the respondents to grade their interest on a five-point scale where five indicates 'very interested in the programme' and one 'not at all interested in the programme' and we classify those who stated the lowest interest in the programme as non-participants.

In our application we choose to use the closed-ended valuation question approach. This was partly as a result of pilot studies since we experienced anchoring problems in an open-ended format such that the stated WTP closely coincided with the current fees for health care utilisation as in e.g. Johannesson (1996). Individuals' WTP is not only dependent on the scenario, but also on the payment mode (Mitchell and Carson, 1989). Thus, individuals may have preferences for the payment mode used and this is supported in several empirical applications (e.g. Green and Tunstall, 1999). In the pilot studies we used a taxed-based and a fee-based payment mode. However, the taxed-based payment mode resulted in a high proportion of protest answers, which were identified in follow-up questions. Thus we decided to use two different fee-based payment modes, allowing us to study the sensitivity to the presented payment mode in the answer. The first mode asked for individuals' WTP in the context that individuals' stated WTP is one way to measure their preferences for a programme. The second mode took another approach by claiming that the programme cannot be financed within the current health care budget and thus the users would have to pay directly. We based the bid vector on results from pilot studies and the final vector consisted of the following bids: 75, 150, 200, 250, 500 and 1000 Swedish kronor (SEK) (9.50 SEK = 1 EURO at the time of the survey). We present the wording of the payment modes in the Appendix. A crucial issue in the interpretation of the elicited WTP is what the respondents have included in their answers and this will influence the other components to be entered into the CBA. Thus, a good knowledge of the components included in their elicited WTP is necessary in order to avoid double-counting or omitting components when including the additional costs and the cost savings of a pro-

gramme in the final CBA. Drummond et al. (1999) identifies three broad types of effects that an individual may have considered; (1) reduced health care costs due to reduced utilisation of health care and reduced use of pharmaceuticals, (2) increased income from working due to reduction in absence from work and (3) a better health status per se. There have been some empirical studies where individuals have been explicitly asked whether or not they took into account factors such as the ones presented above when answering a valuation-question. In general, answers to these types of question have indicated that less than 50 percent of the respondents have considered effects such as reduced health care costs and increased income in the future (e.g. Persson et al., 1995 and Schwab Christie, 1995). We included a follow-up question after the valuation question in order to test for what individuals had included in their answers by posing the following question after the valuation-question: Did you consider that the programme may result in reduced health care costs and perhaps also reduced absence from work in the future?

4. Empirical analysis

The sample of respondents suffering from hand eczema are selected from a mail survey to a random sample of 3000 individuals from the general population of Gothenburg, Sweden, aged between 20 and 65. The questionnaire consisted of questions, which focused on whether or not the respondents had hand eczema and on the degree to which they exposed their hands. The overall response rate was 74 percent after three reminders (Meding and Järvholm, 2002). A telephone interview was then planned with all 215 respondents who had indicated that they suffered from hand eczema. Of these individuals, 182 provided data for the interview. In our analysis we use a sample of 109 respondents since several different formats of the questionnaires were used in this survey for other research purposes, which consequently reduced the number of individuals in our analysis. The telephone interview began with questions related to hand eczema followed by socio-economic questions. Then we performed the CV-survey and finally individuals were asked to state their household income.

In the survey, information was collected on several variables. Firstly there was a battery of socio-economic questions. We used age, education, and long-standing limited illness in the estimations. Total net household income, including any benefits and allowances, was collected in predetermined intervals. We assigned the midpoint income of the appropriate interval to each household. In order to compare income between households, we employ the equivalence scale used by RSV (National Tax Board, Sweden). The scale assigns the first adult the value of 0.95, the following adults are set at 0.7 and each child at 0.61. The logarithm of the equivalence-scaled disposable income (LEQUI) is then calculated. Moreover, we created a score index in order to obtain a mea-

sure of the severity of hand eczema, which is based on an aggregation of several components. The score points were established from results obtained in a previous hand eczema study (Meding, 1990). The number of years since hand eczema first developed was scored at 1 if it was less than 6 years ago, at 2 if 6 – 15 years ago, at 3 if more than 15 years ago. If the hand eczema has been continuous since its development a score of 3 was obtained, while if cortisone creams are used, which may be seen as an objective indicator of the severity, a score of 2 was set. The number of past visits to a physician due to hand eczema was scored 0 if no visits, 1 if one visit, 2 if 2 – 5 times and 3 if more than 5 visits. Finally, self-assessed effect on daily life due to hand eczema was coded as 0 if low, 2 if medium and 3 if high. The variable LSCORE describes the logarithm of the total score obtained. Moreover, we use two different types of payment modes and thus we create a dummy variable to be able to investigate if this has a significant impact on the stated WTP. The dummy variable FINPROB identifies whether the payment mode that concentrates on financial problems in the health care sector was presented. In addition, a dummy variable called REDUCOST is introduced to capture the fact that some individuals have considered the possibility of decreased future health care costs and the possibility of reduced absence from work in the future, which was elicited in the follow-up question. In Table 1 below, we describe and summarise the variables included in the CV-survey.

Table 1

Descriptive statistics

Variable	Description	Mean or proportion	Std dev.
LAGE	logarithm of age	3.636	0.276
LEQUI	logarithm of equivalence-scaled household income	8.927	0.421
EDUA	1 if highest level of education is A-level degree (0 otherwise)	0.468	0.501
EDUUNI	1 if highest level of education is university / polytechnic degree (0 otherwise)	0.330	0.472
LLI	1 if long-limited standing illness (0 otherwise)	0.771	0.422
LSCORE	logarithm of the scores	1.658	0.558
REDUCOST	1 if the subject considered the possibility of decreased future health care costs and the possibility of reduced absence from work (0 otherwise)	0.174	0.381
FINPROB[5]	1 if the individual was presented with the scenario describing financial problems in the health care sector (0 otherwise)	0.523	0.502
LBID	logarithm of the bid offered	5.674	0.847

We analyse the data from the CV-survey by applying a two-part model approach in the estimations of the participation decision and the valuation decision as described in Section 2. The results from the estimations are presented below in Table 2. We perform a RESET type of test in order to assess if the models are misspecified and / or if variables are omitted. This was performed by re-running the regressions when also including the squared, cubic and quadratic values of the predicted value of the dependent variable (e.g. Godfrey, 1988). We cannot reject the hypothesis of correct specification and no omission of relevant variables in the models (p-values 0.57 and 0.37 respectively). We also tested for sample selection but we cannot reject the hypothesis of no sample selection at 5% level (p-value 0.68) (see e.g. van de Ven and van Praag, 1981).

Table 2

Probit model results

	Participation		Valuation	
Variable	Coefficients	Std error	Coefficients	Std error
Constant	2,027	3,696	-5,314	4,334
LAGE	-1,506**	0,619	1,696*	0,912
LEQUI	0,379	0,387	0,698	0,455
EDUA	0,186	0,394	1,073*	0,605
EDUUNI	0,040	0,404	0,312	0,580
LLI	-0,154	0,330	-0,926*	0,480
LSCORE	0,512**	0,260	0,982**	0,471
REDUCOST	0,085	0,410	0,401	0,470
LBID	-	-	-1,495***	0,348
FINPRO	-	-	-1,175**	0,464
n	109		85	
McFadden R^2	0.11		0.43	
RESET (p-value)	0.26		0.06	

* denotes significant at 10 percent level, ** at 5 percent level and *** at 1 percent level.

In both models, the severity of hand eczema has a positive and significant effect on participation as well as on valuation, i.e. increased severity increases both the probability of participating and the probability of answering ‘yes’ to the valuation question, which is in accordance to expectation. Age has a significant negative effect on participation, but a positive effect on the probability

[5] For a discussion on consumption see e.g. Griffiths and Wilkinson (1992).

of being willing to pay the bid presented conditional on participation. Education, measured both by A-level and university degree as highest obtained degree increase the probability of participating and paying the bid presented while it is only significant for WTP amongst those with an A-level degree. A higher income increases both the probability of participating and of giving a positive response to the valuation question among participants, but these effects are insignificant. If the respondents have considered the effects on future health care costs and absence from work, the probability of participating and answering 'yes' to the valuation question increases as expected. In the valuation model the bid is significantly negative at the 1% level, i.e. a higher bid reduces the probability of answering 'yes' significantly as expected. If the participants were presented with the scenario that described financial problems in the health care sector, it resulted in a significantly lower probability of responding positively to the valuation question. One explanation may be that this is a protest to this method of financing the programme and in that case it would be more natural to ask for their valuation of the programme directly as in the other payment vehicle presented.

Proper diagnosis of the disease, avoidance of causal factors, contact allergens and / or skin irritants, treatment and prevention are expected to attain a reduction of the future need for medical care, i.e. of health care utilisation and pharmaceuticals. The cost savings associated with the programme will depend on the severity of the hand eczema, but of course there will also be individual variation. We separate individuals into three broad groups that depend on the severity of their hand eczema by using the total scores calculated as an indicator of severity. Individuals that obtained a score between $0-4$ are classified as having mild hand eczema, $5-7$ as having moderate hand eczema and 8 or more as having severe hand eczema. Based on these groups we estimate the reduction in pharmaceuticals and health care utilisation. In the group with the mildest degree of hand eczema, emollients are the only pharmaceuticals considered necessary. An average consumption of 3600 gram per year (based on use on hands 3 times per day) results in a total cost of 1600 SEK (FASS, 1999).[6] In the case of the medium group, we also consider the need for cortisone cream at a cost of 700 SEK per year, where an average consumption of 10 gram per week is assumed. In the group with individuals indicating the severest degree of hand eczema, additional use of emollients is needed at a rate of 6 times per day. Thus, the costs for medical treatments without the programme are estimated at 1600, 2300 and 3900 SEK per year for an average individual in each group respectively. The costs for pharmaceuticals are on

[6] Given the results in Van der Pol and Cairns (2001) and their summary on previous findings on subjective discount, we used a discount rate of 7.5%, which seemed to be an average. If, instead, we use a discount rate of 5%, the estimated mean cost savings would be 6420, 10232 and 19662 SEK respectively and 10%, the estimated mean costs would be 5211, 8304 and 15957 SEK respectively.

average reduced if the individuals take part in the programme, but since this type of programme has not been implemented the exact effects are unknown. Based on our experience we expect a decrease of 50% in the need for pharmaceuticals. By using a discount rate of 7.5 percent, the estimated mean cost savings from the programme during a 10-year period are; 5775 SEK, 8302 SEK and 14077 SEK in each group respectively. Furthermore, it is expected that the number of visits to physicians will be reduced thanks to the programme. In a population-based survey where the average duration of hand eczema was 12 years, Meding (1990) finds that 20% of the individuals in the sample had once visited a physician due to hand eczema, 27% 2 – 5 times and 22% more than five times. Based on this, we expect the visitation rates per year without the programme for an average individual to be 0 in the mild group, 0.25 in the moderate group and 1 in the severe group. Again, there is no medical evidence of the effects of the programme, but we expect that the number of visits to physicians will be reduced by 50% for an average individual. The total cost of a visit to a GP was about 1000 SEK according to the system used by Stockholm County Council. By using 7.5% discount rate, the average cost savings per group during a 10-year period is; 0, 902 and 3609 SEK. In aggregation, the average cost savings in each group is 5775, 9204 and 17686 respectively.[7] In order to consider individual variation and the uncertainty of the predicted effects of the programme, we assume that the cost savings are uniformly distributed within a range of 775 – 10775 SEK for the mild group, 1704 – 16704 SEK for the moderate group and 2686 – 32686 SEK for the severe group. We estimate the total cost of conducting the programme to be 8000 SEK according to the system used in Stockholm County Council in 1999. This includes the cost of the total service included in the programme as if it were executed at a highly specialised department of dermatology, i.e. the cost includes wages to the occupational dermatologist and assisting personnel, rent for the premises, and all costs for allergy testing and other possible examinations.

In this paper we apply the implicit approach when aggregating the components and we consider two dimensions in our evaluation, namely equivalence-scaled household income and severity of hand eczema. Individuals are divided into three groups based on their equivalence-scaled income; below 5000 SEK, 5000 – 10000 SEK and in excess of 10000 SEK per month, and into three groups depending on the severity of hand eczema; mild, moderate and severe. Thus, we create nine sub-groups for the analysis of the programme. We can then calculate the mean outcome for each sub-group by taking the mean of each individual's net outcome, defined by her WTP calculated from equation (4), as well as the costs and the cost savings for each sub-group separately. In a follow-up question to the CV-part of the survey, we explicitly asked if the

[7] We calculate the confidence interval by setting the lower bound at the number ranked at the 2.5^{th} percentile and the upper bound at the number ranked at the 97.5^{th} percentile of the distribution.

respondents have considered reduction in future health care costs and reduced absence from work (REDUCOST). If, in the subsequent analysis, we set REDUCOST to zero when calculating individuals' WTP from equation (4), we can then include the costs and the cost savings for the government from the programme in the CBA without any risk of double-counting these components since the WTP will only include the health effects per se. However, as described above, there are individual variations in both WTP and the cost savings from the programme, and in order to account for these variations we use the bootstrap technique to generate a confidence interval of the outcomes in each sub-group. Bootstrapping is based on drawings with replacement, thus the observations come from the original collected sample. The bootstrapped sample is then used in the estimation of both the participation and the valuation models, and the parameter values are then used in the calculation of the WTP by using the formula presented in equation (4). In order to obtain a value on the cost savings per individual, we randomly draw a number from one of the three uniform distributions and the one applied depends on the degree of the severity of hand eczema for the individual considered. We replicate the sampling procedure 1000 times, i.e. we create 1000 bootstrapped samples, and in each of them the mean outcome is calculated as described above. In Table 3 we present the mean in each sub-group based on these 1000 simulated means and within brackets we present the 95 percent confidence intervals based on the percentile method.[8]

Table 3

The effect of the programme on different subgroups of the population (in SEK)

Income groups Severity of hand eczema	Low	Medium	High
Mild	-2048 (-2855, -1229)	-1976 (-2392, -1566)	-1789 (-2326, -1232)
Moderate	1429 (53, 2775)	1682 (1146, 2205)	1788 (951, 2621)
Severe	10039 (6894, 13157)	10540 (9325, 11814)	10377 (8492, 12244)

Note. In each square the net mean outcome is shown first followed by the 95% confidence interval in brackets below.

The disaggregated data in Table 3 indicates that the net social benefit is significantly positive in all sub-groups except for those with mild severity. From a public health policy-maker's perspective, the survey's results about indivi-

[8] Descriptive statistics among those who were classified as participants.

duals' interest in the prevention programme are encouraging. The negative net social values in the sub-groups with mild severity is, however, related to the small net revenue for the government in terms of the reduction in usage of health services. This may suggest that a less ambitious programme in terms of costly tests should be considered for individuals with mild severity, since the main effects for them are more likely to be related to increased awareness of preventative activities that they can undertake themselves. In order to compare the results from the sub-groups with the results that would normally be obtained, i.e. by calculating the net social benefit for the whole sample without imposing any distributional weights, we perform the same bootstraps for the total sample. The mean value was estimated at 3065 SEK (2614 to 3527 is the 95% confidence interval), which indicates that the programme should be conducted. However, this figure hides the variations between the nine sub-groups, most notably that it is not worthwhile from a societal perspective for those with only a mild degree of severity. The policy recommendation would be to consider the creation of two different prevention programmes, one for those with mild severity and one for the others. Moreover, given that the confidence interval for the moderate group is close to zero, the decision about whether or not to conduct the programme depends on the discount rate used, where 10% discount rate would have included zero in a 95% confidence interval. However, this suggested revision of the programme has of course to be thoroughly examined in a CBA based on a larger sample before implementation in order to investigate whether it is socially desirable.

5. Conclusions

In contrast with much of the applied economic evaluation, this paper has provided an example of inter-disciplinary research, which spawned fruitful dialogue between medicine and economics about public health issues and implicitly about the future allocation of resources in society. Given the long-term effects of health care activities, especially in the case of prevention where the costs and benefits are spread out over time, CBA is an important tool for investigating the social desirability of a health-related programme in comparison with other uses of the means. In this paper we have discussed and outlined some specific issues to consider when using a CV survey to estimate the value of a health care programme, when the WTP obtained will be included in a CBA. In particular, we have focused on the issue of identifying non-participants in order to apply a two-part model, which correctly describes the demand for a voluntary health care programme. In addition, we stressed the importance of identifying what factors the respondents have included in their stated WTP in order to avoid double-counting or missing out components. Beyond the theoretical problems with determining a monetary value for each

component lie the problems that arise when aggregating the components. As showed in the previous section, an aggregated number, independent of how aggregation is made, hides a great deal of information about the distributional effects of the programme. As indicated by this paper, there are several complexities in performing a CBA when using a CV-survey, thus there are several areas that require further investigation in order to help policy-makers make enlightened decisions. However, the main scope for future research remains in combining inter-disciplinary knowledge in order to perform an accurate CBA of the phenomena studied.

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Appendix

Scenario

Imagine that you consult an occupational dermatologist, who examines your skin, performs an allergy test and inquires about how you use and take care of your hands. The cause of the hand eczema can then usually be explained and you will be given advice on proper skin care for your hands, e.g. choice of suitable creams and protective gloves. In most cases the hand eczema will be improved and sometimes completely cured. Some time after the examination there will be a follow-up consultation to determine if there is any need for additional advice or further examination.

Payment mode alternative 1 (FINPROB=1)

The examination that I have told you about is not covered by the current health care budget, therefore each person who utilises the examination would be required to pay the cost. Would you be prepared to pay a once-and-for-all fee of X SEK for the examination I have told you about?

Yes ☐

No ☐

Payment mode alternative 2 (FINPROB=0)

You may study how different individuals value a certain type of examination by asking them the maximum amount that they would be willing to pay for the examination. Would you be prepared to pay a once-and-for-all fee of X SEK for the examination I have told you about?

Yes ☐

No ☐