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The Contingency of Contingent Valuation
How Much are People Willing to Pay against Alzheimer's Disease?

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Abstract

Contingent valuation has been critizided for delivering divergent estimates of willingness-to-pay (WTP), depending on the elicitation technique. We apply three different techniques to elicit WTP for three programs against Alzheimer's disease. First, the dichotomous choice approach is used. However, giving respondents only a yes/no response alternative seems to result in overestimated WTP. The dissonance-minimizing format screens respondents for their preferences and thus avoids possible yea-saying. The third format, a variant of the payment card, allows respondents to express a level of voting certainty. Our findings suggest that a well-designed coningent valuation survey is a suitable instrument for helping health care decision-makers and that the Swiss population favors a program which improves the situation of informal caregivers regardless of elicitation technique.

JEL Classification Numbers: D61, I18, C42, C52, H42

Keywords: contingent valuation (CV), willingness-to-pay (WTP), Alzheimer's disease (AD), elicitation technique

The contingent valuation (CV) method is one of the most often used methods to measure the value of non-market goods. In hypothetical market scenarios individuals are asked how much a nonpriced good is worth to them. The willingness-to-pay (WTP) questions are constructed by using either continuous or discrete CV formats which vary in their familiarity to respondents and in their potential for biasing WTP values (Donaldson et al., 1998; Johannesson, 1996; Mitchell and Carson, 1989). The researcher faces trade-offs in constructing a hypothetical program which is familiar to the respondents and reducing possible biases. Therefore, choosing the appropriate elicitation technique is crucial since it can influence the absolute magnitude of welfare estimates and finally the outcome of cost-benefit analyses (Boyle et al., 1996; Ready et al., 1996; Welsh and Poe, 1998).

In health economics the CV method is reluctantly used. CV results are critized of being not valid, since they depend so heavily on the choice of elicitation method. However, pressure to justify health treatments and programs in economic terms is mounting if they are to be provided by a national health service or to be included into the benefit package of mandatory health insurance. Therefore, the importance of the CV method is likely to grow.

The present work seeks to find out whether the choice of elicitation technique within a CV framework in fact may result in conflicting recommendations concerning Alzheimer's disease (AD), where costs are extremely high. We apply different elicitation techniques (dichotomous choice, dissonance-minimizing and payment card format) and different estimation methods to investigate whether claims for more intervention designed to release the burden of AD patients and/or their caregivers can be justified economically.

By way of contrast, the National Oceanic and Atmospheric Administration (NOAA) panel recommends that applications of CV should utilize the dichotomous choice (DC) format, which belongs to the discrete CV methods (Portney, 1994). However, the DC format is increasingly being criticized of eliciting too high WTP values. Therefore, support for the payment card (PC) format, which elicits WTP values directly by using a continuous CV format, is growing. In health economics, the debate regarding different elicitation techniques has only just begun (Klose, 1999).

Our findings show that elicited WTP values differ substantially with regard to the elicitation technique and estimation method. Results of the discrete CV methods are two to five times higher than those of the PC format. However, a cost-benefit analysis produces the unambiguous results that a program which improves the situation of informal caregivers is valued highly by the Swiss population, justifying its cost.

The paper is organized as follows: The evaluated programs are described in section 1. Section 2 presents the three elicitation techniques. The estimation methods used to compute WTP values are shown in section 3. The data base is reported in section 4 followed by the results (section 5). In section 6 cost-benefit analyses for the three AD programs are conducted to identify whether an implementation of the programs seems worthwhile. The paper concludes with a summary .

1 Description of the evaluated programs

The chronic debilitating nature of AD makes it one of the most costly diseases. In the U.S. AD is the third most expensive disease (after heart diseases and cancer) with costs to society approaching US$ 100 billion annually which corresponds to 1% of the GDP for the year 2000 (Schumock, 1998; Meek et al., 1998). Looking at annual costs per AD patient, estimated values differ between US$ 20,000 and US$ 65,000 but most studies arrive at an amount of about US$ 50,000 per year and patient (Ernst and Hay 1997; Souêtre et al., 1999). The greatest part of these costs are borne by the patient’s family in form of out-of-pocket payments for services and of hours spent for caring the patient without getting any reimbursement.

Despite the fact that AD cannot be cured until now, there are nevertheless several possibilities to ease the burden for AD patients and/or their caregivers. We elicit the preferences of the Swiss population for three possible health care programs dealing with AD.

The first program 'care' tries to ease some of the strain on informal caregivers which provide the bulk of long-term care to people suffering from AD. To elicit WTP for 'care', a scenario is built in which informal caregivers get a training in caring for demented patients. Additionally, they have the possibility to engage a professional nurse for a few weeks per year for free. Respondents were asked whether they would be willing to pay higher income taxes for such a care program to be implemented.

The program 'diagnosis' focuses on an early detection of AD. While no current therapy can reverse the progressive cognitive decline caused by AD, several pharmacological and psycho-social treatments exist which may delay the proceeding of the illness (Small et al., 1997; Mayeux and Sano, 1999). For these treatments to be effective an early diagnosis of AD is important (Callahan et al., 1995). However, diagnosing AD is a relatively difficult task since there is still no validated test available. Currently, a first diagnostic tool is a screening interview, which inquires into personal details, family contact, and health state. Additionally, a brief quantified screen of cognitive function such as the Mini-Mental State Examination (cf. Folstein et al., 1975) is used. If this first examination results in signs pointing at a possible dementia, a more comprehensive neuropsychological assessment conducted by specialists is needed (Small et al., 1997; van Crevel et al., 1999). To elicit WTP for an early diagnosis of AD we designed a scenario consisting of a routine dementia screening test. Such a routine test is currently not reimbursed by Swiss sick funds. Therefore, respondents were asked whether they would be willing to pay a higher health insurance premium if such an early diagnosis program was reimbursed by the health insurers in the future.

The third program 'research' focuses on research into curing AD. Intensive research all over the world has led to an increasing understanding of the primary factors causing AD (Vassar et al., 1999; Näslund et al., 2000). But despite this knowledge, there exists no causal therapy for AD to date. Our scenario asked respondents for their WTP to intensify research on AD at Swiss universities financed with tax money.

All three programs are of hypothetical character, since they are not implemented in Switzerland yet. To render the scenarios as realistic as possible in a CV study, the choice of the payment vehicle is crucial. In Switzerland, there is a mandatory health insurance with a benefit package covering most (but not all) diagnostic and therapeutical services. This mandatory health insurance is provided by private insurers. A big part of health care expenditures therefore is financed with health insurance premiums paid by the Swiss population. But health insurers are not obliged to cover all health care costs. A considerable amount is financed with tax money from the cantons as well. So it makes sense to finance our hypothetical programs with health insurance premiums or tax money, since people are used to both payment vehicles.

Obviously a research program will be financed with tax money. It is also reasonable to finance the program for early detection of AD by including it among the mandatory benefits of health insurance and thereby raising insurance premiums. For the program ‘care’, however, income taxes and health insurance premiums seem both to be plausible financing methods which leads us to the decision to elicit preferences separately for a care program financed by taxes as well as by health insurance premiums. We only show results of the tax financed care program here. For complete results see Bonato et al. (2001).

2 Elicitation techniques

To elicit WTP values for the AD programs, three different elicitation techniques are applied within a contingent-valuation study: the dichotomous choice (DC) format, the dissonance-minimizing (DM) format and the payment card (PC) format. In the DC question each respondent is given only one price out of a range of predetermined values. The respondents determine whether their WTP is higher or lower than the price offered. The DC format is the most popular elicitation technique for CV surveys because it is similar to market transactions where people are accustomed to deciding whether or not to buy a good at a specific price. However, in the DC format maximum WTP is not elicited directly, but only as a discrete indicator. It therefore requires many more responses for the same level of statistical precision than an elicitation method which elicits WTP values directly (e.g. PC method). In addition, studies imply that the DC method leads to WTP values which exceed those derived in experimental or real-life markets by far (Champ et al., 1997). One possible explanation for the overestimation of WTP values using the DC method is the presence of yea-saying, i.e. the respondents seem to express their motivation for a program instead of giving their true preferences. Therefore, to reduce possible yea-saying we give respondents in a question preceding the WTP question the possibility to show their support for the program regardless of price by asking whether they support the program at all. In addition, instead of using the usual yes/no response, a third alternative (don't know) is given. Following a conservative strategy, respondents who answer their bid question with 'don't know' will be treated as no-responses.

The DM format is an extension of the DC format. Respondents are given five possible statements which distinguish individuals who generally support the program from those who oppose it totally (Blamey et al., 1999). This should reduce possible yea-saying. In addition, the DM format tests for respondents who protest against the payment vehicle but would otherwise support the program. An example of a DM question is shown in the appendix (the complete questionnaire for all programs and elicitation techniques is shown in Bonato et al., 2001).

In addition to the DC and DM format, the PC format is applied where respondents are confronted with an ordered sequence of bids. The bids are the same as in the DC and DM questions. Instead of a simple yes/no response alternative, respondents are allowed to choose between five different responses: yes; rather yes; don't know; rather no; no. This gives respondents the possibility to express a level of voting certainty, since it seems that respondents have a distribution of possible WTP values rather than a single point estimate of the value for a good (Welsh and Poe, 1998). The respondent's WTP lies somewhere in between the maximum amount she would vote for and the lowest amount she would reject. Furthermore, respondents have the possibility to express ambivalence, since they are allowed to make less of a commitment by saying 'rather yes' or 'rather no' than 'yes' or 'no' for sure. Therefore, possible protest answers may be avoided increasing the usable sample size.

3 Estimation methods

We estimate WTP of the discrete CV surveys by using a logistic model with the dependent variable being the choice (yes or no) and the explanatory variables being the bid T together with other variables of interest. An individual answers yes if her utility after the introduction of an AD program (v_1) exceeds her utility of the status quo (v_0). The probability of choosing the program can be expressed as:

$$\Pr(yes) = \left(1 + e^{-\Delta v}\right)^{-1} = \left(1 + e^{-\alpha + \beta T}\right)^{-1}, \tag{1}$$

where $\Delta v = v_1 - v_0 = \alpha_1 + \beta(y - T) - \alpha_0 - \beta y = \alpha - \beta T$ is the difference in utility, $\alpha = \alpha_1 - \alpha_0$ is a constant, and β is the marginal utility of income y (see Hanemann, 1984). With increasing price T the utility difference and therefore the probability of a yes answer decrease.

WTP values depend crucially on the assumptions made on the functional relationship between the bid and the probability of accepting the bid. Therefore, we additionally apply nonparametric analysis which estimates WTP by simply using the proportion of yes answers at each of the different bid levels (see Kriström, 1990).

In the PC format, respondents are confronted with an ordered sequence of bids where they choose the maximum amount they are willing to pay. Following Welsh and Poe (1998) we expand the applied PC format beyond the traditional PC format by letting respondents value each price and allowing them to express uncertainty. Therefore, additional thresholds and likelihood of voting yes are included. However, WTP responses are elicited in form of intervals instead of point valuations. T_L is defined as the maximum amount a respondent would vote 'yes' and T_U to be the lowest amount she would switch to 'rather yes'. WTP then lies somewhere in the switching interval [T_L, T_U]. In a nonparametric as well as a parametric estimation approach the WTP values simply are set at interval midpoints which may bias results. Therefore, in a third approach we apply a maximum bounded likelihood model where the dependent variable is measured on intervals of a continuous scale (Cameron and Huppert, 1989).

4 Data

At the end of 1999 two pretests were conducted. The first pretest ascertained that the respondents did understand the questions asked. The second pretest focused on the range of the bids used in the WTP questions. In February and March 2000, 1,240 personal interviews with individuals aged 18 and older were conducted via telephone in the German part of Switzerland. People were selected randomly by using the telephone book. The sample is representative with regard to age and sex. Besides questions regarding WTP for the three programs, the questionnaire also covered information and familiarity with AD as well as general socioeconomic characteristics.

The whole sample was divided into two main samples: Questionnaire 1 elicited WTP for the two programs 'diagnosis' and 'care', whereas questionnaire 2 investigated the programs 'research' and 'care'. This separation of the programs 'diagnosis' and 'research' was undertaken to avoid bias resulting from a potential embedding effect, i.e. a possible correlation between the responses can occur because respondents do not differentiate between the scales of a program (Poe et al., 1997). In our study, the programs 'diagnosis' and 'research' may be linked, since early detection makes an effective use of a new cure resulting from increased research more likely.

Each of the two main samples was again subdivided into three subsamples according to the three elicitation techniques (DC, DM and PC). In the DC and DM questionnaires, respondents were confronted with only one single bid and therefore a further subdivision of these samples was necessary. We used seven different bids which resulted in a total of 28 subsamples for the DC and

DM method. In the PC method a respondent had to value all bids and therefore there was no need to subdivide these samples further.

In Table 1 descriptive statistics with regard to the socioeconomic characteristics are reported. Since the sample is representative with respect to age and sex, the means for *AGE* and *WOMAN* display nearly the corresponding values for the Swiss population in general. The variable *INFO* shows that knowledge about AD is widespread. Nearly a third of all respondents are very well informed about the disease. Only 17% have made direct experiences with AD having (or having had) a close relative suffering from AD (*RELATIVE*).

The variables *CHILD*, *ALONE, SIBLINGS*, and *PARENT* give some insight on the family background of the respondents. About two thirds have children of their own and almost the same percentage has parents who are still alive. 90% indicate that they have at least one brother or sister and only one fifth lives alone. With respect to the remaining socioeconomic variables one can see that about one third lives in big cities (*PLACE*) and that there are minorities who are well educated (20%, see *EDU_HIGH*) or have a low education level, respectively (13%, see *EDU_LOW*).

>>>>TABLE 1 about HERE<<<<<<<<

5 Results

Table 2 summarizes the results referring to the tax financed care program. We calculate mean WTP by integrating the valuation function. However, the mean is very sensitive towards assumptions about the highest bid, i.e. about the truncation of the upper limit of integration. The maximum bid in this study is CHF 600 (exchange rate May 2001: US$ 1 = CHF 1.70). To test for the sensitivity of the results, we also calculate mean WTP with an infinite maximum WTP as proposed by Haneman (1984). Since including socioeconomic information does not improve the model, the equations with only the bid as explanatory variable are chosen as representative equations (see appendix for detailed results). If CHF 600 is chosen as maximum bid, mean WTP of CHF 285 results for the DC variant and of CHF 229 for the DM variant, respectively. If mean WTP is not truncated at CHF 600, the estimated WTP values increase by 30%. In the nonparametric estimation mean WTP values amount to CHF 288 for the DC and to CHF 243 for the DM variant, respectively. Median WTP on the other hand is a more robust welfare measure than mean WTP since it does not depend on the representation of the whole valuation function. Median WTP values for the program 'care' are substantially lower than the corresponding mean values: CHF 218 and 266 for DC and CHF 60 and 142 for DM.

>>>>TABLE 2 about HERE<<<<<<<<

In the PC format we consider two variants for the calculation of WTP values: The more conservative variant considers only the definite 'yes'-answers as yes-responses, whereas the second variant also includes the 'rather yes'-answers. The parametric and the nonparametric estimations yield almost identical values, though other studies received quite different results depending on the chosen approach (e.g., Cameron and Huppert, 1989; Welsh and Poe, 1998). Mean WTP amounts to CHF 58 (CHF 57) for the 'yes' variant and to CHF 84 (CHF 83) for the 'rather yes' variant, respectively.

Contrary to the program 'care', the estimated intercept of the DC and DM variant of the program 'diagnosis' is never significantly different from zero (see appendix for detailed estimation results). This is due to the high amount of respondents opposing the program. The high amount of no-answers causes problems in fitting a logistic model. Therefore, calculated WTP values (especially mean values) must be interpreted with caution. For the logistic DC model a mean WTP (calculated for a maximum bid of CHF 600 per year) of CHF 164 is estimated, whereas for the logistic DM model a mean of CHF 167 results (see Table 3). For the nonparametric DC (DM) model, mean WTP amounts to CHF 168 (CHF 180) per year. However, because of the high opposition rate for this program, we believe that mean WTP elicited with the discrete CV method (DC and DM) are generally too high. Median WTP values are much smaller for both elicitation and estimation methods. Again, the PC method yields the lowest mean WTP values (between CHF 53 and CHF 65 per year depending on the voting certainty).

>>>>TABLE 3 about HERE<<<<<<<<

We next present the results for the tax financed research program (Table 4). For the logistic DC (DM) model a mean WTP of CHF 201 (CHF 177) is estimated. Mean WTP resulting from the nonparametric DC (DM) model amounts to CHF 187 (CHF 171). Again, the PC method yields the lowest WTP values (between CHF 100 and CHF 128 depending on the certainty level). However, the difference to the other two elicitation techniques is smaller than in the programs 'care' and 'diagnosis'.

>>>>TABLE 4 about HERE<<<<<<<<

Comparing the results of the DC and DM format for the three programs shows that the DC method generally elicits higher mean WTP values for both estimation methods (logistic and nonparametric). For the program 'care' mean WTP values of the DC method exceed mean WTP values of the DM method by 19% to 25%. For the program 'research' the DC format elicits mean WTP which is greater by 9% to 24% than for the DM method. However, for the program 'diagnosis' mean WTP values of the logistic as well as nonparametric DC model are slightly smaller than corresponding mean WTP values of the DM model. A possible explanation may be found in the small support for the program 'diagnosis'. Only 54% of the DC respondents support this program in the question preceding the bid question. Therefore, yea-saying may not be a problem in this program.

Our results that WTP values depend on the elicitation technique confirm former findings of e.g., Welsh and Poe (1998); Hackl and Pruckner (1999). The PC method yields amounts which are two to five times lower than results from the discrete CV method (DC and DM). The DC method generally elicits the highest mean and median WTP values. The DM method therefore indeed seems to mitigate some problems like yea-saying resulting in lower WTP values.

6 Cost-benefit analysis

To identify whether a program's benefits exceed its cost a cost-benefit analysis for each of the three AD programs is conducted. From a conservative point of view the implementation of a program seems worthwhile as long as the program's benefit (WTP), computed with the lowest value (PC method) exceeds its cost and hence generates a net social benefit. Cost-benefit analysis is based on the principles of welfare economics. The general decision rule in cost-benefit analyses is that a project should be carried out if the net benefits are positive. This is in accordance with the Kaldor-Hicks compensation principle and therefore leads to a potential Pareto improvement (see e.g. Drummond et al., 1997).

In addition, the cost-benefit analyses can be used to derive a ranking for programs. The more net benefits a program generates to society the more favourable its implementation is. The ranking of programs is important if they are competing, i.e. it is only possible to carry out one of a number of programs (see e.g. Johannesson, 1996).

The cost of the program 'care' per AD patient (consisting of a two-day course for informal caregivers and the hiring of a professional nurse for four weeks) sum up to about CHF 9,300 per year (according to the health department of the city of Zurich and the Swiss Nurses Association). In Switzerland, 32,000 AD patients are cared for by informal caregivers at patients' homes (Volz, 2000). Therefore, if all of these patients were to take advantage of the care program, maximum possible costs of CHF 298 million would arise. These costs are then compared to the elicited benefits which are calculated by multiplying the elicited WTP values with the number of the Swiss population of 18 years and older. Table 5 shows that the choice of the elicitation technique affects results in a substantial way. While the DC and DM method always lead to a considerable positive net benefit between CHF 483 million and CHF 1,270 million per year, the PC method yields significantly smaller values (between CHF 21 million and CHF 164 million). However, it is more realistic to assume that not all patients will enroll in the care program what will lead to higher net benefits. Therefore, from a societal point of view the implementation of the program 'care' can be recommended.

Another possibility is to use the median voter theorem (Mueller, 1989) which leads to a cost-benefit analysis on an individual level since median WTP of the program is compared to cost per capita. This form of cost-benefit analysis is interesting for countries with strong democratic institutions like the U.S. and Switzerland. Both political systems contain elements of direct democracy which makes referendums about single programs possible. The political decision makers of these countries are therefore not only interested whether a program generates more benefits than cost, but whether it would pass a potential referendum. Looking at the median voter, we obtain a recommendation for the program 'care' as well. Again we are using maximum possible cost yielding CHF 54 per person on average. Compared to the median WTP values of CHF 266 and CHF 142 (DC and DM), a net benefit of CHF 212 and CHF 88 results which will lead to an acceptance of the program in a possible referendum since more than 50% of the voters exhibit higher benefits than cost.

>>>>TABLE 5 about HERE<<<<<<<<

The program for an early diagnosis of AD is described as an office-based dementia screening test. It is based on a routine diagnostic investigation with regard to cognitive functions like concentration and memory. If, after this routine investigation, persons are suspected of having AD, a more comprehensive assessment takes place to check whether the diagnosis is true. Such diagnostic tests for dementia already exist and they are relatively cheap. According to the health department of the city of Zurich average cost of such an interview based routine screening are about CHF 75 per patient. If a more comprehensive assessment becomes necessary, additional costs of CHF 2,000 arise. The average incidence of AD for a population aged 65 years and older is about 2.5% (see Hebert et al., 1995) resulting in 25,600 new cases per year for Switzerland. Therefore, we assume that the suspicion rate – calling for the more comprehensive assessment – will not be higher than 5% of all persons enrolled in this screening program. Maximum costs occur if the whole population aged 65 years and older (about 1 million people in Switzerland) were to enroll. Therefore, our benchmark scenario consists of a participation rate of 100% and a suspicion rate of 5% resulting in maximum total cost of CHF 175 million per year. The net benefit (total WTP minus total cost) is positive (between CHF 100 million and CHF 744 million) for all but one (Median, DC) elicitation techniques (see Table 6). Median WTP in the DC method is computed using statistically non-significant estimation coefficients which leads to this very low value. Therefore, the values for this method have to be treated with caution. Again net benefits will rise when using more realistic participation rates. Since net benefits are positive even when the suspicion rate is doubled (not shown), we conclude that the implementation of the program ‘diagnosis’ generally can be recommended.

>>>>TABLE 6 about HERE<<<<<<<<

But even if the cost-benefit ratio is favorable from a societal point of view there is no guarantee that the program would win a referendum. 46% of the DC respondents opposed the program 'diagnosis' in general. Though WTP of the other 54% still outweighs the costs of implementation, a referendum would only succeed – assuming everyone votes – if median WTP is higher than cost per capita. Using the DM values, a suspicion rate higher than 10% (with a participation rate of 100%) could already lead to a failure of the program in a referendum. However, arguing with more realistic, lower usage rates will reduce implementation costs to an amount where the program would be accepted by the median voter. Looking at the DC values, the program 'diagnosis' would never pass a referendum.

In the program 'research' universities are supported with tax money in their search of a cure for AD. Cost-benefit analysis for this program can be conducted very easily. If WTP per capita is projected to the entire Swiss population this yields the yearly maximum amount of tax money to be spent for AD research. This amount again differs substantially with regard to the elicitation technique (see Table 7). When looking at the mean and median values the range of this maximum amount lies between CHF 561 million and CHF 1,056 million. A positive net benefit is guaranteed if not more than the lowest WTP value (CHF 561 million) is spent to intensify research on AD resulting in maximum net benefits of CHF 495 million per year.

>>>>TABLE 7 about HERE<<<<<<<<

Table 8 summarizes the results of the cost-benefit analyses. From a societal point of view, all three programs generate a positive net benefit (under reasonable assumptions). Therefore, implementation of each program can be recommended. However, the question arises whether all three programs could be implemented together. Since we elicited respondents' WTP for each program separately, our data does not allow to answer this question. When implementing only a single program one therefore has to decide which of the three should be chosen. The program ‘care’ generally generates the highest net benefits and its implementation seems to be most worthwhile. Comparing the program ‘care’ and ‘research’, net benefits of the former are always higher. Since nearly 50% of respondents opposed the diagnosis program but only about 20% the research program, we conclude that the latter is more likely to win a possible referendum. Therefore, based on comparison of social costs and benefits, the ranking of the three programs seems to be ‘care’, ‘research’, and ‘diagnosis’.

>>>>TABLE 8 about HERE<<<<<<<<

One major drawback of the CV method is that WTP for a commodity is usually elicited isolated from other commodities. Our study focuses only on AD and does not consider other diseases. Therefore, results have to be treated with caution when AD competes with other diseases in the political process. In this case WTP questions have to be adjusted. In addition, decision makers in the health care field are often confronted with the problem of how to spend a fixed budget. In this case the opportunity costs of any service expansions are reflected in the benefits that would have been obtained from corresponding service reductions (Shackley and Donaldson, 2000).

7 Conclusions

Many industrialized countries are concerned with increasing health care expenditure, not least due to the growing prevalence of Alzheimer's disease (AD). Pressure is growing to justify high costs of treatment in economic terms. One approach is the contingent valuation (CV) method. In a survey, people are asked for their willingness-to-pay (WTP) for a nonpriced commodity. However, there exist different elicitation techniques which may lead to divergent WTP results. Until now, no elicitation technique has been proven to be superior (Klose, 1999).

In our study we apply the discrete as well as the continuous CV format (dichotomous choice, DC and payment card, PC). In addition, we use the dissonance-minimizing (DM) format, which gives respondents more than only a yes/no response alternative and screens respondents for their preferences. Specifically, by allowing respondents to support a program regardless of price and allowing them to protest against the payment vehicle, less bias, and therefore lower WTP values are expected than with the DC format (Blamey et al., 1999).

The aim of our study is to find out whether the sensitivity of WTP estimation with regard to choice of elicitation technique may result in conflicting recommendations based on divergent WTP estimates. This issue is of particular importance for AD, a prevalent, devastating, and costly disease. In the coming decades, as the population segment older than 65 years increases, the economic burden of AD is likely to become even more pronounced. Three particular programs are analyzed. The program 'care' tries to ease some of the strain of informal caregivers. The program 'diagnosis' focuses on early detection of AD, which is required for existing therapies to be effective. The program 'research' intensifies the search for a cure against AD.

Our results confirm that the DC format elicits higher mean and especially median WTP values than the DM format. We conclude that a discrete elicitation technique, which allows screening respondents for their preferences, is preferred to the yes/no response format. However, all variants of the discrete CV format need strong assumptions about the form of the valuation function, increasing the potential for manipulating WTP values. This is less of a problem if median WTP is used as welfare measure since it does not depend on assumptions about the tails of the valuation function and is, therefore, more robust than mean WTP.

Contrary to the DC and DM format, the PC format does not need to make any assumptions about the valuation function. Regarding the design of the PC format, we use a modified version. Instead of choosing the maximum WTP out of an ordered sequence of bids, respondents have to value each bid. In addition, respondents are given five different responses (yes, rather yes, don't know, rather no, no) allowing them to express a level of voting certainty. This permits us to elicit WTP values depending on respondents' certainty that they would pay the price. Furthermore, the PC format needs assumptions about respondents' maximum WTP values, since they are elicited in form of intervals rather than point estimates.

For all three programs considered, the PC method elicits the lowest WTP values. But even for these values a positive net benefit results when they are compared to the costs. From a societal point of view each of the three programs can be implemented. However, it is not clear whether all three programs should be implemented together. The program 'care' generally generates the highest net benefits and its implementation seems most worthwhile, followed by the programs 'research' and 'diagnosis'.

The literature on cost-benefit analysis in health care is growing. Our study adds to the know-how necessary for performing CV studies in this area. The different elicitation techniques crucially influence the outcome of the cost-benefit analysis. However, since all programs are hypothetical we are not able to test WTP results for their validity. Therefore, we recommend to elicit a range of WTP values instead of giving a single number. For a single elicitation technique to be recommended, more research into the validation of the different methods is needed, preferably through actual behavior in real markets.

8 Appendix

8.1 Application of the DM format

An application of the DM format is shown for the program 'care'. Respondents are asked:

"Which of the following five statements most closely resembles your view?"

(1) I support the care program with an increase in income taxes of CHF …

(2) I support the care program and the use of income taxes but it is not worth CHF … to me.

(3) I support the care program and the use of income taxes but I cannot afford CHF …

(4) I support the care program but not if it requires increasing income taxes.

(5) I oppose the care program regardless of whether it costs me anything.

In the calculation of WTP, respondents who choose statement 1 will be treated as yes-responses, whereas those who support the program but are not willing to pay the price offered (statements 2 and 3) will be treated as no-responses, as well as statement 5. To test for possible protest answers against the payment vehicle respondents who choose statement 4 are given three more statements:

(6) I would pay CHF … for the care program if I could be convinced that the government doesn't have enough public funds to pay for it.

(7) I would pay CHF … for the care program if an alternative acceptable way of collecting the money could be found.

(8) I cannot afford to pay anything for the care program.

Respondents who choose statements 6 or 7 are treated as yes-responses in the calculation of WTP values, whereas statement 8 belongs to no-responses.

8.2 Estimation results

>>>>TABLE 9-14 HERE<<<<<<<<

9 References

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Table 1: Descriptive statistics of the full sample

Variable	Description	Average	Std. Deviation	Observations
AGE	Respondent's age, measured in years.	47.12	16.55	*N* = 1180
WOMAN	Respondent's sex: 1 = woman, 0 = man.	0.50	0.50	*N* = 1180
INFO	Is respondent informed about Alzheimer's disease (AD) or related diseases? 1 = yes, 0 = no.	0.30	0.46	*N* = 1180
RELATIVE	Does respondent have a near relative (parents, grandparents, sisters or brothers) affected by AD? 1 = yes, 0 = no.	0.17	0.38	*N* = 1180
CHILD	Does respondent have children? 1 = yes, 0 = no.	0.67	0.47	*N* = 1175
ALONE	Does respondent live alone? 1 = yes, 0 = no.	0.20	0.40	*N* = 1174
SIBLINGS	Does respondent have sisters or brothers? 1 = yes, 0 = no.	0.91	0.28	*N* = 1174
PARENT	Are respondent's parents alive? 1 = yes or at least one, 0 = no.	0.69	0.46	*N* = 1174
PLACE	Does respondent live in a large village/city? 1 = yes, 0 = no.	0.37	0.48	*N* = 1159
EDU_LOW	Respondent's education: 1 = only mandatory school, 0 = else.	0.13	0.33	*N* = 1174
EDU_HIGH	Respondent's education: 1 = at least college education, 0 = else.	0.21	0.40	*N* = 1174

Table 2: Summary of the program 'care' – WTP, CHF p.a.

			Mean (Max WTP 600)	Mean (Max WTP infinite)	Median
DC	Logit		285	375	266
	Nonpara		288	335	218
DM	Logit		229	290	142
	Nonpara		243	249	60
PC	Para	'yes'	58	-	-
		'rather yes'	84	-	-
	Nonpara	'yes'	57	-	-
		'rather yes'	83	-	-

Table 3: Summary of the program 'diagnosis' – WTP, CHF p.a.

			Mean (Max WTP 50)	Mean (Max WTP infinite)	Median
DC	Logit[b]		164	200	3
	Nonpara		168	244	46
DM	Logit[b]		167	188	50
	Nonpara		180	195	38
PC	Para	'yes'	56	-	-
		'rather yes'	65	-	-
	Nonpara	'yes'	53	-	-
		'rather yes'	64	-	-

[a] The bid amount for the program 'diagnosis' represents monthly insurance premiums.

[b] Nonsignificant *INTERCEPT* or *BID* variable. Results have to be interpreted with caution.

Table 4: Summary of the program 'research' – WTP, CHF p.a.

			Mean (Max WTP 400)	Mean (Max WTP infinite)	Median
DC	Logit		192	233	184
	Nonpara		187	308	95-141[a]
DM	Logit[b]		170	232	114
	Nonpara		171	321	142
PC	Para	'yes'	102	-	-
		'rather yes'	128	-	-
	Nonpara	'yes'	100	-	-
		'rather yes'	120	-	-

[a] The valuation function is horizontal for a probability of answering with yes of 0.5.

[b] Nonsignificant *INTERCEPT* or *BID* variable. Results have to be interpreted with caution.

Table 5: Cost-benefit analysis for the program 'care'

Elicitation method	WTP per capita (CHF p.a.)	Total WTP[a] (million CHF p.a.)	Net benefit using maximum costs (million CHF p.a.)
Mean			
DC	285	1,568	1,270
DM	229	1,260	962
PC 'yes'	58	319	21
PC 'rather yes'	84	462	164
Median			
DC	266	1,463	1,165
DM	142	781	483

[a] Computed for the Swiss population of 18 years and older (about 5.5 million).

Table 6: Cost-benefit analysis for the program 'diagnosis'

Elicitation method	Net benefit participation: 100% suspicion rate : 5% (million CHF p.a.)	Net benefit participation: 50% suspicion rate : 5% (million CHF p.a.)	Net benefit participation: 20% suspicion rate : 5% (million CHF p.a.)
WTP Mean			
DC	727	815	867
DM	744	831	884
PC 'yes'	133	221	273
PC 'rather yes'	183	270	323
WTP Median			
DC	-158	-71	-19
DM	100	188	240

Table 7: Cost-benefit analysis for the program 'research'

Elicitation method	WTP per capita (CHF p.a.)	Total WTP[a] (million CHF p.a.)	Net benefit using costs of CHF 561 million (million CHF p.a.)
Mean			
DC	192	1,056	495
DM	170	935	374
PC 'yes'	102	561	0
PC 'rather yes'	128	704	143
Median			
DC	184	1,012	451
DM	114	627	66

[a] Computed for the Swiss population of 18 years and older (about 5.5 million).

Table 8: Summary of cost-benefit analyses

Program	Maximum cost (millions CHF p.a.)	Total WTP (millions CHF p.a.)	Net benefit (millions CHF p.a.)
Care	298	319-1,568	21-1,270
Diagnosis	175	17-919	-158-774
Research	561	561-1,056	0-495

Table 9: Program 'care' - coefficients of the logistic DC and DM model (t value)

	DC			DM		
Regressor variable	**E_1**	**E_2**	**E_3**	**E_1**	**E_2**	**E_3**
INTERCEPT	0.858***	0.851***	0.934***	0.466*	0.484*	0.572***
	(4.292)	(4.216)	(4.395)	(2.323)	(2.372)	(2.636)
BID	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.004***
	(-4.469)	(-4.288)	(-4.436)	(-4.253)	(-4.123)	(-4.332)
AGE			-0.006			-0.001
			(-0.510)			(-0.062)
WOMAN			0.364			0.096
			(1.319)			(0.330)
INFO			0.166			-0.311
			(0.559)			(-1.056)
RELATIVE			0.504			0.316
			(1.445)			(0.839)
CHILD			0.011			0.221
			(0.035)			(0.663)
ALONE			-0.038			-0.160
			(-0.102)			(-0.459)
SIBLINGS			-1.079*			0.582
			(-2.001)			(1.248)
PARENT			0.023			0.227
			(0.054)			(0.571)
PLACE			0.376			-0.290
			(1.363)			(-1.134)
EDU__LOW			-0.535			-0.813
			(-1.149)			(-1.708)
EDU__HIGH			0.429			0.670*
			(1.258)			(2.046)
N	280	274	274	270	261	261
Log-likelihood	-182.286	-178.932	-171.469	-174.859	-169.821	-162.520
LR test						
E_j vs. E_0	22.16***	20.21***	35.14***	20.78***	19.38***	33.98***
E_j vs. E_2			14.93			14.60
WTP in CHF p.a.						
Mean (Bid_{max}=600)	285	289	287	229	234	228
Median	266	274	272	142	150	154

*,**,*** Coefficient different from zero with an error probability of 5%, 1%, 0.1%.

Table 10: Program 'care' - coefficients of the parametric PC model (t value)

Subsample	'yes'		'rather yes'	
Regressor variable	**Midpoint estimates**	**Interval estimates**	**Midpoint estimates**	**Interval estimates**
INTERCEPT	1.424	0.229	1.668	0.614
	(0.809)	(0.096)	(0.926)	(0.265)
AGE	0.011	0.013	0.0004	0.002
	(0.699)	(0.724)	(0.026)	(0.110)
WOMAN	-0.063	-0.030	0.214	0.238
	(-0.166)	(-0.068)	(0.551)	(0.558)
INFO	0.033	0.104	-0.220	-0.234
	(0.085)	(0.236)	(-0.562)	(-0.550)
RELATIVE	0.373	0.493	0.581	0.598
	(0.853)	(0.993)	(1.296)	(1.240)
CHILD	-0.271	-0.356	-0.393	-0.396
	(-0.528)	(-0.591)	(-0.749)	(-0.691)
ALONE	-0.361	-0.386	-0.065	-0.063
	(-0.862)	(-0.793)	(-0.153)	(-0.134)
SIBLINGS	2.219	3.322	2.598	3.554
	(1.704)	(1.696)	(1.948)	(1.845)
PARENT	-0.400	-0.489	-0.740	-0.739
	(-0.735)	(-0.753)	(-1.327)	(-1.248)
PLACE	0.539	0.598	0.672	0.652
	(1.499)	(1.435)	(1.824)	(1.660)
EDU__LOW	-0.961	-1.200	0.037	0.039
	(-1.846)	(-1.747)	(0.069)	(0.068)
EDU__HIGH	0.251	0.279	1.076*	1.097*
	(0.504)	(0.503)	(2.115)	(2.037)
σ	0.877***	0.918***	0.898***	0.910***
	(8.124)	(6.183)	(8.124)	(6.711)
N	33	33	33	33
Log-likelihood	-42.488	-46.498	-43.268	-52.493
LR test	9.37	9.78	11.28	11.20
WTP in CHF p.a.				
Mean	58	58	86	84

*,**,*** Coefficient different from zero with an error probability of 5%, 1%, 0.1%.

Table 11: Program 'diagnosis' - coefficients of the logistic DC and DM model (t value)

	DC			DM		
Regressor variable	E_1	E_2	E_3	E_1	E_2	E_3
INTERCEPT	-0.012	-0.031	-0.066	0.185	0.169	0.216
	(-0.058)	(-0.151)	(-0.311)	(0.897)	(0.808)	(0.96)
BID	-0.042***	-0.041***	-0.041***	-0.046***	-0.045***	-0.052***
	(-4.005)	(-3.872)	(-3.725)	(-4.417)	(-4.262)	(-4.386)
AGE			-0.01			0.005
			(-0.797)			(0.403)
WOMAN			0.01			0.318
			(0.037)			(1.031)
INFO			0.381			-0.494
			(1.238)			(-1.552)
RELATIVE			-0.163			0.843*
			(-0.443)			(2.168)
CHILD			-0.214			-0.89*
			(-0.667)			(-2.544)
ALONE			0.294			-0.311
			(0.756)			(-0.859)
SIBLINGS			-0.427			-0.061
			(-0.87)			(-0.129)
PARENT			-0.217			0.131
			(-0.496)			(0.314)
PLACE			-0.153			0.242
			(-0.528)			(0.805)
EDU__LOW			0.44			0.176
			(0.946)			(0.378)
EDU__HIGH			-0.685			0.929**
			(-1.812)			(2.709)
N	279	273	273	271	262	262
Log-likelihood	-167.198	-164.086	-159.131	-164.117	-159.313	-148.248
LR test						
E_j vs. E_0	19.38***	17.96***	27.87**	24.08***	22.22***	44.35***
E_j vs. E_2			9.91			22.13*
WTP in CHF p.a.						
Mean (Bid_{max}=600[a])	164	164	161	175	176	167
Median	3	9	20	48	45	50

*,**,*** Coefficient different from zero with an error probability of 5%, 1%, 0.1%.

[a] Asked as increase in monthly insurance premium, i.e. Bid_{max} per month = CHF 50.

Table 12: Program 'diagnosis' - coefficients of the parametric PC model (t value)

Subsample	'yes'		'rather yes'	
Regressor variable	Midpoints estimates	Interval estimates	Midpoints estimates	Interval estimates
INTERCEPT	-0.137	-0.125	1.609	1.590
	(-0.097)	(-0.097)	(1.467)	(1.488)
AGE	0.025	0.028	-0.001	0.002
	(0.893)	(1.110)	(-0.027)	(0.075)
WOMAN	-0.406	-0.393	-0.215	-0.247
	(-0.883)	(-0.943)	(-0.602)	(-0.710)
INFO	-0.444	-0.517	-0.002	-0.061
	(-0.970)	(-1.235)	(-0.006)	(-0.175)
RELATIVE	0.900	0.838	0.386	0.382
	(1.577)	(1.607)	(0.872)	(0.880)
CHILD	0.178	0.088	0.500	0.467
	(0.251)	(0.134)	(0.908)	(0.854)
ALONE	-0.282	-0.303	0.019	-0.029
	(-0.601)	(-0.710)	(0.052)	(-0.082)
SIBLINGS[a]	-	-	-	-
PARENT	1.093	1.083	0.387	0.365
	(1.205)	(1.313)	(0.550)	(0.532)
PLACE	-0.438	-0.079	-0.421	-0.393
	(-0.089)	(-0.176)	(-1.104)	(-1.059)
EDU__LOW	-0.197	-0.386	-0.528	-0.637
	(-0.257)	(-0.549)	(-0.889)	(-1.083)
EDU__HIGH	0.248	0.161	0.421	0.400
	(0.330)	(0.234)	(0.721)	(0.705)
σ	0.819***	0.718***	0.636***	0.591***
	(6.633)	(6.295)	(6.633)	(6.068)
N	22	22	22	22
Log-likelihood	-26.823	-35.217	-21.259	-32.429
LR test	8.55	9.23	6.22	6.37
WTP in CHF p.a.				
Mean	60	56	68	65
Median	43	43	55	55

*,**,*** Coefficient different from zero with an error probability of 5%, 1%, 0.1%.

[a] *SIBLINGS* is dropped from the regression due to collinearity.

Table 13: Program 'research' - coefficients of the logistic DC and DM model (t value)

	DC			DM		
Regressor variable	**E_1**	**E_2**	**E_3**	**E_1**	**E_2**	**E_3**
INTERCEPT	0.809***	0.883***	1.111***	0.397	0.401	0.423
	(3.745)	(4.016)	(4.556)	(1.866)	(1.854)	(1.829)
BID	-0.005***	-0.005***	-0.006***	-0.004***	-0.003***	-0.004***
	(-4.463)	(-4.556)	(-5.083)	(-3.416)	(-3.251)	(-3.292)
AGE			-0.001			0.018
			(-0.072)			(1.399)
WOMAN			0.015			0.312
			(0.052)			(1.066)
INFO			0.296			-0.414
			(0.958)			(-1.342)
RELATIVE			1.100**			-0.312
			(2.797)			(-0.856)
CHILD			0.155			-0.540
			(0.459)			(-1.477)
ALONE			0.013			-1.315**
			(0.033)			(-3.119)
SIBLINGS			-0.212			-0.556
			(-0.407)			(-1.309)
PARENT			0.192			-0.402
			(0.46)			(-0.985)
PLACE			0.058			0.085
			(0.198)			(0.297)
EDU__LOW			-0.215			-1.011*
			(-0.517)			(-2.457)
EDU__HIGH			0.749			-0.052
			(1.858)			(-0.137)
CURABLE			0.902***			0.488
			(3.229)			(1.793)
N	277	271	271	270	262	262
Log-likelihood	-181.187	-176.454	-163.55	-179.509	-174.926	-162.44
LR test						
E_j vs. E_0	21.63***	22.60***	48.40***	12.37***	11.16***	36.12***
E_j vs. E_2			25.81*			24.97*
WTP in CHF p.a.						
Mean (Bid_{max}=400)	189	193	192	170	173	170
Median	175	185	184	112	117	114

*,**,*** Coefficient different from zero with an error probability of 5%, 1%, 0.1%.

Table 14: Program 'research' - coefficients of the parametric PC model (t value)

Subsample	'yes'		'rather yes'	
Regressor variable	**Midpoints estimates**	**Interval estimates**	**Midpoints estimates**	**Interval estimates**
INTERCEPT	1.708	1.551	2.399*	2.115*
	(1.755)	(1.597)	(2.440)	(2.062)
AGE	-0.002	-0.002	-0.010	-0.010
	(-0.118)	(-0.150)	(-0.647)	(-0.636)
WOMAN	-1.839***	-1.943***	-1.371***	-1.625***
	(-4.463)	(-4.466)	(-3.294)	(-3.535)
INFO	0.423	0.370	0.389	0.412
	(1.141)	(1.021)	(1.037)	(1.024)
RELATIVE	2.411***	2.526***	2.062***	2.226***
	(4.078)	(4.047)	(3.452)	(3.489)
CHILD	2.281***	2.411***	1.984***	2.140***
	(4.538)	(4.348)	(3.907)	(3.745)
ALONE	1.812***	1.815***	1.326**	1.369*
	(3.645)	(3.514)	(2.640)	(2.522)
SIBLINGS	-1.570	-1.515	-1.058	-0.984
	(-1.865)	(-1.821)	(-1.245)	(-1.127)
PARENT	2.072***	2.104***	1.593**	1.728**
	(3.937)	(4.048)	(2.996)	(3.107)
PLACE	0.431	0.428	0.504	0.584
	(1.399)	(1.434)	(1.621)	(1.805)
EDU__LOW	1.041*	1.158*	0.721	0.859
	(2.323)	(2.431)	(1.592)	(1.779)
EDU__HIGH	0.876*	0.908**	0.844*	0.871*
	(2.489)	(2.584)	(2.372)	(2.359)
CURABLE	1.222***	1.356***	1.141**	1.189**
	(3.296)	(3.439)	(3.046)	(3.076)
σ	0.672***	0.620***	0.679***	0.658***
	(7.616)	(6.036)	(7.616)	(6.366)
N	29	29	29	29
Log-likelihood	-29.624	-40.324	-29.922	-43.651
LR test	30.71**	31.81**	25.95*	27.64**
WTP in CHF				
Mean	99	102	117	128
Median	79	84	93	103

*,**,*** Coefficient different from zero with an error probability of 5%, 1%, 0.1%