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Abstract

To decide how much resources to spend on reducing mortality risk, governmental agencies in several countries turn to the value of a statistical life (VSL). VSL has been shown to vary depending on the size of the risk reduction, which indicates that WTP does not increase near-proportional in relation to risk reduction as suggested by standard economic theory. Chained approach (CA) is a stated preference method that was designed to deal with this problem. The objective of this study was to compare CA to the more traditional approach contingent valuation (CV). Data was collected from 500 individuals in the Swedish adult general population using two web-based questionnaires, whereof one based on CA and the other on the CV method. Despite the two different ways of deriving the estimates, the methods showed similar results. The CV result showed scale insensitivity with respect to the size of the risk reduction and disease duration and resulted in more zero and protest response. The CA result did also vary depending on the procedure used, but not when chaining on individual estimates. The CA result was also found to be more sensitive to disease duration and severity. This study provides support for the validity of studies of the WTP for a risk reduction. It also shows that CA is associated with encouraging features for the valuation of non-fatal road traffic accidents, but the result does not support the use of one method over the other.

Keywords: contingent valuation, chained approach, scale sensitivity, risk reduction, willingness-to-pay

JEL codes: D61 D80 I18 J17

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1. Introduction

To decide how much resources to spend on reducing mortality risk due to road traffic accidents, governmental agencies in several countries turn to the Value of a Statistical Life (VSL). The VSL is the Marginal Rate of Substitution (MRS) of wealth for risk of death and can be derived by asking people to make a hypothetical tradeoff (stated preferences) or to observe the actual tradeoff on existing markets (revealed preferences). Reviews and meta-analyses of VSL reveal a rather large variation in existing estimates (de Blaeij et al. 2003; Hultkrantz and Svensson 2012; Lindhjem et al. 2011). The gross domestic product per capita and the size of the risk reduction are some of the major explanatory factors of this variation. That the VSL varies depending on the size of the risk reduction indicates that Willingness To Pay (WTP) does not increase near-proportional in relation to risk reduction, which is suggested by standard economic theory and referred to as scale sensitivity (Hammitt and Graham 1999). It has been argued that the variation in VSL due to the size of the risk reduction could be due to diminishing marginal utility of safety (de Blaeij et al. 2003; Persson et al. 1995). Lindhjem et al. 2011 do however find that VSL is higher when the risk reduction is not visually displayed or explained and that studies passing scope sensitivity test produce VSL that vary less with the size of the risk reduction, suggesting that scale insensitivity – i.e. an inability to understand and value small risk reductions - is a contributing factor.

Contingent Valuation (CV) is a standard stated preference method where respondents are simply asked to state their WTP for a reduction in risk. Alternative stated preference approaches have been suggested after finding problems with scale sensitivity when estimating the value of risk reduction of non-fatal and fatal risk of road traffic accidents using the CV approach (Beattie et al. 1998; MW. Jones-Lee et al. 1995). The Standard Gamble (SG) approach has been suggested as an alternative to CV for estimating the value of prevention of non-fatal road traffic injuries (MW. Jones-Lee et al. 1995), while the Chained Approach (CA) – a combination of

CV and SG – has been suggested as an alternative for estimating the VSL (Carthy et al. 1999). SG was found to be more sensitive to disease severity compared to CV and the structure of the questions was considered to have several advantages such as encouraging respondents to a more careful consideration of the entire prognosis of each health state, focus on own circumstances, creating a situation that respondents might encounter in real life, and not requiring the respondent to understand small baseline risks and trade-off money for small risk reductions (MW. Jones-Lee et al. 1995). CA is a method that was developed after finding that scale sensitivity arises because respondents have difficulties comprehending the implications of small risk reductions and instead consider the risk reduction intervention as "improving safety". Thus, instead of considering the magnitude of the risk reduction, they simply state an amount that does not seriously disrupt their budget. By breaking down the task in two parts and avoiding asking respondents to trade-off money for risk, it was assumed that these cognitive restraints would be overcome (Beattie et al. 1998). The method has been shown to be sensitive to scope, easy to understand and internally consistent (Carthy et al. 1999) and has been used to generate results that were accepted by the Department of Transportation (DoT), UK.

To our knowledge, CA has only been used once since it was introduced, in an OECD study of the VSL for adults and children (Alberini et al. 2010). The result showed much lower zero responses compared to the CV results and it was also sensitive to disease duration. However, similar to Carthy et al. 1999, indirect chaining was found to produce higher VSL. Also, CA produced much lower VSL than CV. This is due to relying solely on WTP to avoid an injury with certainty (ex post) in the first step of the chain.

A version of the CA has also been used to derive a value of a QALY in the studies European Value of a QALY (EuroVaq Team 2010) and Social Value of a QALY (SVQ) (Baker et al. 2010). Baker et al. 2010 tried using either ex post or ex ante WTP in the first part of the chain. The ex post WTP was recommended as the ex ante WTP was not sufficiently sensitive to the size of the risk reduction. However, the ex ante WTP scenario was framed as a risk elimination scenario. Risk elimination has been found to be associated with an extra value due to individuals no longer needing to spend any time on worrying about the risk or make decisions on how to handle it (Viscusi et al. 1987). Consequently, scale sensitivity could be offset by the existence of a certainty premium.

The aim of this study is to compare CA and CV as methods for estimating the value of risk reduction of both non-fatal and fatal road traffic accidents. In contrast to previous applications of CA, it relies on an ex ante WTP approach in the first part of the chain without framing the question in terms of risk elimination. Using the ex ante perspective limit the risk of respondents hitting their budget constraint and allows the value of risk reduction per se to be included. This perspective is also generally considered appropriate in the context of public decision making for health care programs (Gafni 1991). This is also the first study to test the impact of the health state used in the chaining on the CA result and the first study to use CA for estimating the value of reducing risk of non-fatal injuries.

The following presentation is organized as follows. Section 2 describes the theoretical framework, while section 3 presents the details of the methods used. The result is presented in Section 4 and the article ends with a discussion of the result in Section 5.

2. Theoretical background

2.1 VSL and VSI derived in the direct approach

The theoretical model for VSL builds upon the assumption of individuals being expected utility maximizers. The individual faces a situation in which she may die with a certain probability or stay alive. The expected utility (E(U)) in this situation is a function of the probability of death (p) and the utility of wealth when being alive (L(W)) or dead (D(W)) (eq.1) (M. Jones-Lee 1974).

$$(Eq.1) \quad E(U) = (1-p)L(W) + (p)D(W)$$

Differentiating the equation while holding expected utility constant gives the MRS_D between wealth and mortality risk reduction, which is equal to the VSL (eq.2).

$$(Eq.2)\ \ MRS_D = \left.\frac{dw}{dp}\right|_{E(U)\ constant} = \frac{L(W) - D(W)}{pD'(W) + (1-p)L'(W)}$$

To estimate the VSL in CV studies, respondents are asked for their WTP for a small mortality risk reduction.

It can be shown that – given certain reasonable assumptions – VSL will be an increasing function of baseline risk and wealth (M. Jones-Lee 1974). The baseline risk of a fatal road traffic injury is low and it is usually assumed that the demand function is close to horizontal at this level. This would imply that the VSL do not differ much depending on the baseline risk. A meta-analysis of VSL in road traffic accidents do however show a significant impact of baseline risk on VSL (de Blaeij et al. 2003), suggesting that the demand function is downward sloping even at this risk level.

It is also generally assumed that WTP is an increasing, concave function of risk reduction and it is standard to assume that WTP should increase close to proportional in relation to risk reduction (Hammitt and Graham 1999). If WTP is shown to increase with the size of the risk reduction it is said to exhibit weak scale sensitivity. If it also increases close to proportional in relation to risk reduction it is considered to have strong scale sensitivity. Most empirical studies on VSL show weak scale sensitivity, but fail to show strong scale sensitivity (de Blaeij et al. 2003; Hultkrantz and Svensson 2012; Lindhjem et al. 2011). Failure of scale sensitivity can be a consequence of survey design (Corso et al. 2001), but evidence also points to cognitive restraints in respondents when it comes to understanding and valuing small reductions in risk (Andersson and Svensson 2008). Respondents who are more confident about their answers have been shown to be more sensitive to the size of the risk reduction (Hammitt and Graham 1999).

The theoretical model for the Value of a Statistical Injury (VSI) is based upon the same reasoning as VSL, with the exception of replacing risk of death by risk of non-fatal injury (q), alive with "normal health" (H) and death by "non-fatal injury" (I) (eq.3).

$$(Eq.3)\ MRS_I = \left.\frac{dw}{dq}\right|_{E(U)constant} = \frac{H(W) - I(W)}{pI'(W) + (1-q)H'(W)}$$

2.2 VSL derived in the indirect/chained approach

The indirect or chained approach was developed in response to the failure of the CV method to show strong scale sensitivity (Beattie et al. 1998; Carthy et al. 1999). The method is based on two steps, whereof the first involves estimating the MRS between wealth and risk of a non-severe non-fatal injury and the second step involves estimating the relative utility loss for death and the non-severe non-fatal injury.

2.2.1 First step: MRS of wealth for risk of a non-severe non-fatal injury

Provided that several reasonable assumptions hold; (i) the marginal utility of wealth is not significantly affected by an injury of lesser severity (i.e. $I'(W)=H'(W)$), (ii) normal health is preferred to the injury (i.e. $I(W)=H(W)-\alpha$), and (iii) individuals prefers more wealth to less and are financially risk averse (i.e. $H'(W)>0$, $H''(W)<0$) it can be shown that the MRS of wealth for the risk of a non-severe non-fatal injury is larger than the WTP of avoiding the injury with certainty and smaller than the WTA to sustain the same injury with certainty. Thus, by specifying the utility function and deriving the WTP and WTA for a certain injury it is possible to estimate the MRS of wealth for risk of a non-severe non-fatal injury (Carthy et al. 1999).

We use a different approach to estimate the MRS in this study. This approach means asking respondents to pay for a complementary insurance that would cover the cost of a treatment that would restore the respondent to full health within a week if the respondent would suffer a non-severe non-fatal injury. Framing the question this way means that the MRS is derived directly and there is no need for specifying the utility function. Furthermore, this type of payment is more similar to the way healthcare is actually payed for and it is therefore assumed to lead to less protest responses. Finally, by including demand side uncertainty we take explicit account of risk aversion. However, it could be argued that by reintroducing risk in the first part of the chain we are back to the problem that the chained approach was meant to solve, i.e. that respondents have difficulties understanding the size and meaning of a risk reduction. The risk used in our survey is however much larger (at least 1 per 1000) compared to what has been used when finding problems with scale sensitivity. Furthermore, the chained approach asks respondents to consider risk at this level in the SG procedure (see 2.2.2). Finally, the respondents are only asked to understand the meaning of the absolute risk level since they do not pay for a risk reduction.

2.2.2 Second step: Relative utility loss for death in relation to a non-severe non-fatal injury

The second part of the chain is aimed at finding the relative utility loss between death and the non-fatal non-serious injury by using a modified SG question. The modification involves adding a small risk in what is usually framed as the 'certain' treatment in order to make respondents gamble. The respondent is asked to assume that she has been injured in a road traffic accident and able to choose between (1) a treatment that if successful leads to the non-fatal non-serious injury (I), but if unsuccessful leads to death with probability θ, or (2) a treatment that if successful leads to normal health (H) within a few days, but if unsuccessful leads to death with probability ρ (ρ>θ). The level of ρ at which the respondent is indifferent between treatments for a given level of θ can then be used to derive the relative utility loss between death and the non-fatal non-serious injury (Carthy et al. 1999) (eq.4).

$$(Eq. 4)\ \frac{MRS_D}{MRS_I} = \frac{H(w) - D(w)}{H(w) - I(w)} = \frac{1-\theta}{\rho-\theta}$$

2.2.3 Chaining of the first and second step to derive MRS of wealth for risk of death (or severe injury)

The VSL or MRS_D can be derived by multiplying the relative utility loss by the MRS_I (eq.5).

$$(Eq. 5)\ MRS_D = \left(\frac{MRS_D}{MRS_I}\right) MRS_I$$

To test for internal consistency, the authors of the first presentation and application of the chained approach used indirect chaining by including a less severe injury (X) (eq.5 vs eq.6).

$$(Eq. 6) MRS_D = \left(\frac{MRS_D}{MRS_I}\right)\left(\frac{MRS_I}{MRS_X}\right) MRS_X$$

We apply this test, but also include a test that derives the relative utility loss indirectly by including a more *severe* injury (Y) (eq.7). We also estimate MRS for non-fatal injuries (eq.8) and test whether the MRS differ depending on the health states used in the chaining (eq.8 vs eq.9).

$$(Eq.7) MRS_D = \left(\frac{MRS_D}{MRS_Y}\right)\left(\frac{MRS_Y}{MRS_I}\right) MRS_I$$

$$(Eq.8) MRS_Y = \left(\frac{MRS_Y}{MRS_I}\right) MRS_I$$

$$(Eq.9) MRS_Y = \left(\frac{MRS_Y}{MRS_X}\right) MRS_X$$

3. Methods

3.1 Study design

The study is performed as a web-survey of samples of the Swedish general population identified from internet panels. Two questionnaires were constructed and distributed, whereof one based on CA and the other based on the CV method. The questionnaires were designed to elicit preferences for three non-fatal injuries (Slight, Moderate, and Severe) and one fatal injury. Injury descriptions were based on the EQ-5D-5L questionnaire (Table 1). The CV questionnaire included seven scenarios where respondents were asked what they would pay for a mobile phone application that could reduce the risk for a certain injury (Table 2). The CA questionnaire included four WTP scenarios where respondents were asked what they would pay for an insurance that would give them access to a cure if they were injured. The CA questionnaire also included six SG scenarios. The first two SG scenarios aimed at generating a chained value for the moderate injury. The third and fourth SG scenarios aimed at generating a chained value for the severe injury and to study the impact of health state used in chaining. The fifth scenario aimed at generating a chained value for death, and the sixth scenario aimed at generating an indirect chained value of death. Examples of scenarios are included in Appendix.

<<Table 1>>

<<Table 2>>

3.2 Questionnaire design

The first part of the questionnaire included questions about the respondent and her transportation habits, experience of accidents, and risk perception. The respondent was also asked to state her cost for traffic safety and opinion of public road safety investment in order for the respondent to get a sense for what is reasonable to spend on traffic safety and to remind respondent of the tradeoff between cost and safety.

The WTP-part started with an introduction to the WTP concept and respondents were then asked to think about if their household could afford to pay a number of predefined amounts in order to make them consider their budget constraint. The respondents were then presented with the injury descriptions and asked to rate them on a visual analogue scale (VAS) from 0 (worse possible health state) to 100 (best possible health state). Next, the respondents were presented with a risk description. The CV questionnaire presented the risk of being injured in a road traffic accident per 100,000 people. The risk was displayed using a pie chart and references to a large arena or city. To display the concept of risk in the CA questionnaire, the respondent was asked to click on 1 out of 1000 blue dots which made one of them – randomly chosen by the computer – turn grey.

After being presented with the WTP scenario, the respondent was shown one amount at a time in numerical order (SEK1, 50, 100, 500, 1,000, 1,500, 2,000, 3,000, 4,000, 5000, 7,000, 9,000 per year) and asked whether she would pay or not pay the amount, a version of the Payment Card (PC) procedure (Covey et al. 2007; Bateman et al. 2002). Amounts were presented both per month and per year. The range of amounts were set to identify non-payers and to cover what are assumed to be the range of WTP estimates in these kind of studies (Johannesson et al. 1996; Svensson 2009). Secondly, the respondent was presented with the highest amount she would pay and the lowest amount she would not pay and asked to state her WTP in an open question. Before responding to the WTP question, the respondents were asked to assume that they would not suffer any loss of income if they would become injured and could not work.

Respondents were then asked to rate (on a scale from 0 to 10) how sure she is that she would pay the amount if she were given the opportunity to buy the good for that price. This question is assumed to reduce hypothetical bias, i.e. WTP responses deviating from what the respondent would pay for real (Blumenschein et al. 2001; Loomis 2014).

The respondents were also asked to state their reasons for paying or not paying using debriefing questions. The CA questionnaire included a follow-up section where it was possible for respondents to review and change their WTP when comparing WTP in different scenarios. Respondents to both questionnaires were also presented with their total WTP for several scenarios and asked if they would be prepared to pay this amount to receive the combined benefit. If the respondent answered no, she was asked to state a new summarized amount.

The SG part of the CA questionnaire started with an introduction to the SG method and an explanation of the purpose of the questions. An interval division approach (EuroVaq Team 2010) was applied to elicit the point of indifference in the SG questions. The respondents were asked to choose between treatment X (e.g. Slight injury for 3 months and 1 in 100 risk of Moderate injury for 3 months) and treatment Y (e.g. normal health within a week and between 1 and 99 in 100 risk of Moderate injury for 3 months). A maximum of four questions were asked, varying the risk associated with treatment Y depending on the answer of the respondent (Figure 1). If the respondent was not indifferent between treatments at any of the four questions asked, the intermediate risk (between the highest risk rejected and accepted) was assumed to be the point of indifference. Debriefing questions was included to check the reason behind the answers of maximum gamblers, non-gamblers, and indifferent respondents at the first risk presented.

<<Figure 1>>

3.3 Sample

A web-based version of the questionnaire was sent to a randomly stratified sample of individuals from the adult Swedish population drawn from an internet panel. The panel respondents were offered a minor incentive for their participation. Data was collected in June (CV) and October (CA) 2015. The questionnaires were sent to about 2,000 individuals. About half started to answer the questionnaire and a third completed the questionnaire. The majority of the respondents who choose not to complete the questionnaire dropped out in the rating of health states or in the WTP scenarios. The mean age and share of women were significantly higher in the CA questionnaire compared to respondents of the CV questionnaire (Table 3). Respondents were older, more educated, and had a higher household income compared to the general population.

<<Table 3>>

3.4 Analysis

Respondents classified as protesters or outliers where excluded in the main WTP analysis. Protesters are respondents who do not want to pay because they think the government should pay or respondents who state any WTP because they know they do not have to pay for real (Bateman et al. 2002). Outliers are defined according to the definition of a box plot, i.e. WTP responses that exceed the 75th percentile plus 1.5 times the interquartile range (Lind et al. 2005; Matthews et al. 2016). A subgroup analysis was also performed where respondents who rated below 10 on the certainty calibration question were excluded. The cutoff at 10 has been supported by previous research (Svensson 2009), while other studies argues for only treating the respondents rating 7 as certain (Loomis 2014). If respondents chose to change their WTP after reviewing them in the follow-up section, their final WTP responses were used in the main analysis. The WTP in the main analysis was also adjusted if the respondent was not prepared to pay the summarized amount of several scenarios. The adjustment was made by multiplying the WTP by a factor derived by dividing the new total sum by the old total sum. WTP is reported in SEK (SEK1=US$0.12).

The main analysis of the SG responses excluded protesters, irrationals and indifferent at similar risk. Protesters are respondents who provided invalid reasons for taking the highest risk possible or being indifferent at the first risk presented. Irrationals are respondents choosing the treatment with a worse outcome despite it having similar risk as the treatment with a better income.

The VSI and VSL based on the CV method were calculated by dividing the mean WTP for each injury (s) by the pre-defined risk reduction (eq.10).

$$(Eq.10)\ \text{VSL or }\ \text{VSI}_s = \frac{\frac{1}{\text{N}}\sum_{\text{i}=1}^{\text{N}} \text{WTP}_{\text{s,i}}}{\Delta\ \text{risk}_s}$$

The VSI and VSL based on the CA method was calculated by multiplying the relative utility loss derived from the risk-taking in treatment y (p_y) in relation to risk in treatment x (p_x) with the MRS of wealth for risk of the non-fatal injury derived by dividing the mean WTP per year for a cure of a certain injury (s) by the pre-defined risk of that injury (p_s) (eq.11). The chaining is performed on mean estimates in the main analysis since chaining on individual estimates give too much weight to extremes (Baker et al. 2010; Gyrd-Hansen and Kjaer 2012).

$$(Eq.11)\ VSL\ or\ VSI_s = \left(\frac{(1-p_x)}{\left(\frac{1}{\text{N}}\sum_{\text{i}=1}^{\text{N}} p_{y,i} - p_x\right)}\right)\left(\frac{\frac{1}{\text{N}}\sum_{\text{i}=1}^{\text{N}} \text{WTP}_{\text{s,i}}}{p_s}\right)$$

A Wilcoxon Signed Ranks Test was used to test for significant differences within groups and a Mann-Whitney U Test was used to test for significant differences between groups.

An OLS regression was performed to validate and explain the result, using the log of WTP as the dependent variable and age, age squared (defined as (age-mean age)^2), sex, university education, log of income per consumption unit (Statistics Sweden 2015), response in certainty calibration, transportation habits, injury experience, risk experience and risk perception as explanatory variables. The log of WTP and other variables is used to take account of the skewed distribution of WTP and to make the result easy to interpret. Age squared is used to assess if the relationship with WTP takes the form of an inverted U (Shepard and Zeckhauser 1984). The OLS regression was performed for all scenarios pooled. A separate regression was performed where zero WTP responses were included by assigning them a small amount (SEK1).

4. Results

4.1 CV

The WTP was significantly different between all scenarios among all respondents, indicating weak scale sensitivity. The differences were however not near-proportional, i.e. no evidence of strong scale sensitivity. A more close to proportional increase in WTP was found in the main analysis, both with respect to disease duration (main: 43% vs all: 27%) and size of the risk reduction (severe: 35% vs 10%; fatal: 30% vs 14%) (Figure 2-3, Table 4). These changes are still not near-proportional considering that the disease duration increased by 4 (from 3 to 12 months) and the size of the risk reduction increased by 2 (from 25% to 50%). Around half the sample gave the same WTP irrespective of the size of disease duration and risk reduction. This could indicate that these respondents did not consider these aspects or that the budget sets a limit on the valuation. The share of respondents stating similar WTP for different disease severity was lower, suggesting that the responses are more sensitive to this aspect.

<<Figure 2>>

<<Figure 3>>

<<Table 4>>

4.2 CA

The WTP result from the CA questionnaire did also show evidence of weak scale sensitivity, but not strong scale sensitivity. A slightly more close to proportional increase in WTP was found in the main analysis with respect to disease duration (main: 18% vs all: 16%) and risk of injury (main: 16% vs all: 13%). These changes are still not near-proportional considering that the disease duration increased by 4 (from 3 to 12 months) and the risk of the injury increased by 5 (from 2 to 10 per 1000). Compared to the CV result, the CA result appears to show less scale sensitivity. An explanation for this is that the budget constraint puts more limit on the WTP in the CA survey, where risks are high. Thus, there might be a tradeoff between a high enough risk to make it tangible and a low enough risk to avoid an income effect. There were less zero responses, protesters, and outliers and more certain respondents found based on the CA results compared to the CV results. This could suggest that the CA scenarios were more realistic and/or acceptable among respondents.

<<Figure 5>>

<<Figure 6>>

<<Table 5>>

The risk-taking differed significantly between all SG scenarios among all respondents. According to expectations, the risk-taking decreased when there was a worse outcome of the risk (Table 6). Even though the duration of the moderate injury increased by four (from 3 to 12 months), the risk-taking in the main sample only increased by 31%. This result is thus not in accordance with the QALY-model, but similar to the increase in WTP in the CV questionnaire (43%). The share of irrationals was lowest in the scenario where respondents were asked to take a risk to avoid a permanent health loss. The respondents included in the main sample were younger and had a higher education.

<<Table 6>>

4.3 Comparison of CV and CA

Despite the two different ways of deriving VSI and VSL, the methods showed similar results (Table 7). The relative utility losses based on CA were however more similar to the relative utility losses based on VAS and EQ-5D (Table 8), suggesting that these estimates are more sensitive to the disease severity and duration. As expected, the VSI for severe injury and the

VSL differed depending on the risk reduction used in the CV method. The CA result did however also vary depending on the procedure used to elicit them, i.e. failed to show invariance. The results based on chaining from the Moderate injury were around twice as high as the result based on chaining from the Slight injury. Furthermore, the VSL based on indirect chaining were – with one exception - 31-38% higher compared to VSL based on direct chaining. When chaining on individual estimates (Table 9), the procedural invariance increases and there are almost no differences under the assumption that individuals did not take into consideration that there was a risk in treatment X. However, the estimates are higher and no longer as similar to CV.

Income was related to the WTP in both questionnaires (Table 10). Respondents who drove a car at least once a week and respondents who believed that they could impact risk to a large degree had a higher WTP in the CV questionnaire. Age was related to WTP in the CA questionnaire according to the expected U-shape form, but had no impact on WTP in the CV questionnaire. When including zero responses, a higher rating of subjective risk was related to a higher WTP in CA. This is according to expectations. Women had a higher WTP in CV when including zero responses. Having a high worry of being involved in a road traffic accident was related to a lower WTP in CV when including zero responses. This is contrary to what would be expected. A possible explanation is that those who had a high worry did not see a value in a mobile phone application reducing risk since the behavior of others and the outcome of a possible accident would remain unchanged.

<<Table 7>>

<<Table 8>>

<<Table 9>>

<<Table 10>>

5. Discussion

This study has compared the CV and CA methods for estimating the value of reducing risk of non-fatal and fatal road traffic injuries. Despite two different ways of deriving these estimates, the methods produce similar VSI and VSL. This would support the validity of studies of WTP for a risk reduction. The result does suggest that CA is more sensitive to disease duration and severity and present more realistic WTP scenarios with respect to non-fatal road traffic accidents. These findings would support the use of CA over CV when estimating the value of reducing risk of non-fatal road traffic injuries. However, CA was associated with scale insensitivity and the health state used in the chaining had an impact on the result. Since both CV and CA are associated with inconsistencies that causes an almost equally large variation in the estimates, the result does not show that one method can be recommended over the other.

Although both CV and CA showed evidence of weak scale sensitivity, none showed strong scale sensitivity. With respect to disease duration, there are theoretical reasons to support a non-proportional increase in WTP (Pinto-Prades et al. 2009; Robinson et al. 2013). Expectations of adaptation and adjustment to the injury might for example discount the health loss over time. Both CV and SG increased by 30-40% even though the duration increased by four, suggesting that the preferences are non-proportional with respect to disease duration. The WTP has however been shown to increase proportionally with respect to disease duration in a previous study that varied the duration of a serious, temporary injury from 6 to 12 months between samples (Persson et al. 1995). The increase in duration in this study (3 to 12 months) could have been too large to reveal a proportional result considering the budget constraint of the individual and the maximal risk-taking to avoid a temporary injury. An indication of the income effect being an important explanation for the insensitivity to scale is that the result showed more scale sensitivity when trimming the results from outliers. With respect to the size of the risk reduction, there are theoretical reasons to support diminishing marginal returns to safety (de

Blaeij et al. 2003; Persson et al. 1995). However, the increase would still be expected to be near-proportional. This was not the case in this study. Since the scenarios varying the size of the risk reduction in CV appeared in the end and since the risk increased by five in CA, the income effect might be a reason for this insensitivity as well. The similar results for CA and CV do however indicate scale sensitivity between samples since the risk in these scenarios differed.

Similar to the findings of previous applications of CA (Alberini et al. 2010; Carthy et al. 1999), the result showed that indirect chaining gave higher estimates. The study also showed that the health state used in the chaining had an impact on the result. These inconsistencies did however disappear under the assumption that respondents did not take the risk of treatment X into account and using individual chaining. This would support the internal consistency of the method, in contrast to the CV approach. However, the VSL was almost twice as high compared to the CV result when using these adjustments. A possible reason why the VSL is higher in the CA method is that the context of death is a medical intervention. The context of death has been shown to have an impact on VSL (Alberini and Scasny 2013; Van Houtven et al. 2008; Olofsson et al. 2016), and if death due to a medical intervention causes more dread than death due to a road traffic accident it would be expected to result in a higher estimate. Thus, the CA method might have some limitations when the context of death is assumed to matter. Another limitation of the CA method is that it does not present the true baseline risk or relevant risk reduction to the respondent. Previous research would suggest that these factors have an impact on preferences (de Blaeij et al. 2003; Persson et al. 1995). Thus, the higher VSI for severe injury and VSL in CA might be due to respondents never being presented with the real baseline risk.

The differences between the methods could in part have been caused by the sample responding to the CA questionnaire having a higher mean age and share of women. A slightly different version of the CA questionnaire with response characteristics similar to CV (results not reported here) showed somewhat higher VSI for temporary injuries and slightly lower VSL and VSI for permanent injuries compared to the CA result reported here. This suggests that the sample characteristics have an impact on the result. Compared to another study using PC to elicit the WTP for an ambulance helicopter service (Gyrd-Hansen 2016), the rate of protest response (11 %) was similar in CV (11-15%) but lower in CA (5-7%). The rate of zero responses was lower in both surveys (CV: 13-18%; CA: 5-7%; ambulance study: 28%). An explanation for this is that the PC-procedure started out with an extremely low amount (SEK1). The rate of outliers was higher in both surveys (CV: 6-13%; CA: 5-7%; ambulance study: 1%). The reason for this could be the use of another definition of outlier in this study. Another reason is the design of the PC-procedure that showed one amount at a time. This could have had the effect of a bidding game, which has been shown to result in higher WTP (Frew et al. 2004). The trimming of outliers did show more scale sensitivity, suggesting that the insensitivity were to some part driven by a minor share with high WTP. The result was also adjusted in relation to the total WTP.

The rate of non-gamblers in the SG scenarios was high. This was also shown in the first application of the method (Carthy et al. 1999). The likely reason is that respondents are asked to take a risk for a permanent outcome to avoid living with a temporary outcome. This study showed that a large share of respondents who express indifference at the first risk presented in the interval division procedure did so out of uncertainty and not to express their preference. When using this method to derive the point of indifference it is therefore important to elicit the reasons for choosing indifference in the first iteration. A relative large part of respondents were categorized as irrational (choosing a treatment with worse outcome despite it having the same risk as a treatment with better outcome). This would indicate that they did not understand the scenario and the design made it possible to identify them. A limit with this design however, is that respondents were allowed to choose Y without any incremental risk-taking.

The most reliable estimates of VSL in this study are in the range USD 5-5.9 million. This is similar to the trimmed mean estimate in a global meta-analysis (Lindhjem et al. 2011) of 850 VSL estimates (USD 5 million) and the mean estimate in a review of all Swedish VSL estimates since 1995 of a certain quality (USD 4.1 million) (Hultkrantz and Svensson 2012). The VSI estimates are more difficult to compare to previous studies since the type of injuries for which VSI are estimated differ. VSI for a temporary injury vary between USD 0.02-0.16 million in this study, which can be compared to USD 0.04-0.31 million in Persson et al 1995 and USD 0.94-1.04 million in Jones-Lee et al 1995. VSI for a permanent injury vary between USD 1.49-3.42 million in this study, which can be compared to USD 0.91-2.29 million in Persson et al 1995 and USD 1.28-4.35 in Jones-Lee et al 1995. The higher result in the study by Jone-Lee et al 1995 could be due to no trimming of results.

Consistent with previous research CA was found to be sensitive to disease severity, easy to understand and internally consistent. This study also showed that CA performed better than CV in all of these aspects. However, the ex ante WTP reintroduces scale insensitivity and the health state used in the chaining was shown to have an impact on the result. CV might still be preferable as a method to derive VSL since CA does not specify the size of the real baseline risk or the appropriate context. For VSI, this study does not tell what method might be preferred over the other. Although CA shows encouraging features, there needs to be more research into the reasons for scale insensitivity and failure of procedural invariance.

Tables

Table 1. Health state descriptions

Health state (questionnaire label)	**EQ-5D-5L health state**	**Description**
Slight injury ("yellow")	11221	• No problems in walking about. • No problems washing and dressing yourself • Slight problems doing usual activities • Slight pain and discomfort • Not anxious or depressed • Seen as outpatient in hospital (only CV)
Moderate injury ("orange")	22332	• Slight problems in walking about • Slight problems washing and dressing yourself • Moderate problems doing usual activities • Moderate pain and discomfort • Slightly anxious and depressed • 1-3 days in hospital (only CV)
Severe injury ("brown")	44443	• Severe problems in walking about • Severe problems washing and dressing yourself • Severe problems doing usual activities • Severe pain and discomfort • Moderately anxious and depressed • 1-3 days in hospital (only CV)
Fatal injury ("black")	-	• Immediate unconsciousness followed shortly by death.

Table 2. Questionnaire design

Type of injury[a]	Contingent Valuation (CV)[b]	Chained Approach (CA)
Slight injury, 3 months	WTP to reduce risk from 200 per 100,000 to 100 per 100,000 (50 %)	WTP (1a) to insure for cure of injury at a risk of 2 in 1000
		WTP (1b) to insure for cure of injury at a risk of 10 in 1000
Moderate injury, 3 months	WTP to reduce risk from 60 per 100,000 to 30 per 100,000 (50 %)	WTP (2a) to insure for cure of injury at a risk of 1 in 1000.
		Chained via WTP (1a) + SG1: slight vs moderate, 3 months
Moderate injury, 12 months	WTP to reduce risk from 60 per 100,000 to 30 per 100,000 (50 %)	WTP (2b) to insure for a cure of injury at a risk of 1 in 1000.
		Chained via WTP (1a) + SG2: slight vs moderate, 12 months
Severe injury, permanent	WTP to reduce risk from 12 per 100,000 to 9 per 100,000 (25 %)	Chained via WTP (1a) + SG3: slight vs severe
	WTP to reduce risk from 12 per 100,000 to 6 per 100,000 (50 %)	Chained via WTP (2b) + SG4: moderate vs severe
Fatal injury	WTP to reduce risk from 4 per 100,000 to 3 per 100,000 (25 %)	Chained via WTP (2b) + SG5: moderate vs fatal
	WTP to reduce risk from 4 per 100,000 to 2 per 100,000 (50 %)	Indirect chained via WTP (1a) + SG2 and SG5
		Indirect chained via WTP (1a) + SG3 and SG6: severe vs fatal
		Indirect chained via WTP (2b) + SG 4 and SG6

[a]Injury defined according to EQ-5D-5L health states: Slight injury (11221); Moderate injury (22332); Severe injury (44445).
[b]Baseline risk based on the risk for a slight (Injury Severity Score, ISS=1-3) injury, moderate (ISS=4-8) injury, severe (ISS=9+) injury and fatal (death within 30 days from the accident) injury due to a road traffic accident in Sweden 2013.

Table 3. Sample characteristics

Variable	Contingent Valuation (CV) (n=255)	Chained Approach (CA) (n=257)	p-value
Mean age (Std.Dev.)	52.0 (15.1)	55.7 (17.7)	0.0108
Females	48.6 %	56.4 %	0.0777
One adult in household	26.3 %	31.9 %	0.1613
Child in household	27.1 %	21.4 %	0.1357
University education	48.2 %	48.7 %	0.9275
Employed	50.2 %	45.9 %	0.3332
Mean household income per month[a]	42,991	42,064	0.2197

[a]Optional question, CV n=224; CA n=235, transformed from interval using intermediate values.

Table 4. Mean WTP (Std.Dev), median in CV (SEK per year)

	(1) Slight 3 months	(2) Moderate 3 months	(3) Moderate 12 months	(4) Severe, permanent 25 %	(5) Severe, permanent 50 %	(6) Fatal 25 %	(7) Fatal 50 %
All	577 (1005), 120	831 (1380), 250	1053 (1815), 300	1582 (2637), 450	1740 (3080), 500	2286 (9781), 400	2603 (12861), 400
Excl. protesters[a] and uncertain[b]	394 (791), 30	521 (932), 88	926 (2425), 50	1735 (3138), 163	2048 (3863), 100	2290 (4218), 50	2405 (4193), 100
Excl. protesters and outliers[c]	270 (325), 100	512 (603), 250	704 (880), 300	871 (1157), 300	1253 (1638), 500	801 (1143), 300	1128 (1578), 500
Excl. protesters and outliers, using final value[d] (main analysis)	**168 (255), 50**	**304 (405), 116**	**435 (673), 150**	**526 (852), 188**	**708 (1079), 225**	**489 (843), 137**	**638 (1080), 194**
Zero response	13 %	14 %	13 %	13 %	14 %	18 %	18 %
Protesters	11 %	13 %	13 %	13 %	13 %	14 %	15 %
Outliers	13 %	9 %	7 %	11 %	6 %	13 %	9 %
Certain	15 %	14 %	14 %	15 %	14 %	16 %	17 %

[a]Non-payers “because government should pay” or “can’t download mobile-apps” + Payers stating any amount “because they do not have to pay”.
[b]Below 10 on a scale from 0 to 10.
[c]According to the definition of a boxplot (exceeding Q3 + 1.5 * (Q3-Q1)), (1)>SEK1444; (2)>SEK2425; (3)>SEK3624; (4)>SEK4850; (5)>SEK6100; (6)>SEK4884; (7)>SEK6725.
[d]Final value = (new total wtp/old total wtp) * wtp.

Table 5. Mean WTP (Std.Dev.), median in CA (SEK per year)

	(1) Slight, 2 per 1000	(2) Slight, 10 per 1000	(3) Moderate, 3 months	(4) Moderate, 12 months
All	946 (1310), 500	1072 (1430), 500	1313 (1589), 600	1529 (1895), 1000
Excl. protesters[a] and uncertain[b]	666 (1025), 150	919 (1402), 165	1098 (1416), 500	1081 (1572), 500
Excl. protesters and outliers[c]	760 (828), 500	885 (947), 500	1064 (1052), 550	1257 (1247), 1000
Excl. protesters and outliers, using final value[d] (main analysis)	**594 (657), 396**	**707 (804), 450**	**822 (881), 500**	**970 (1077), 500**
Zero response	7 %	7 %	7 %	5 %
Protesters	6 %	6 %	7 %	5 %
Outliers	5 %	5 %	7 %	5 %
Certain	21 %	18 %	17 %	16 %

[a]Non-payers “because government should pay” + Payers stating any amount “because they do not have to pay”.
[b]Below 10 on a scale from 0 to 10.
[c]According to the definition of a boxplot (exceeding Q3 + 1.5 * (Q3-Q1)), (1)>SEK3600; (2)>SEK3600; (3)>SEK4700; (4)>SEK5640.
[d]Final value = (new total wtp/old total wtp) * (adjusted)wtp.

Table 6. Mean risk (Std.Dev.), median in treatment Y at indifference between treatment alternatives

	(SG1) Slight 3m vs moderate 3m	**(SG2) Slight 3m vs moderate 12m**	**(SG3) Slight 3m vs severe, permanent**	**(SG4) Moderate 12m vs severe, permanent**	**(SG5) Moderate 12m vs fatal**	**(SG6) Severe, permanent vs fatal**
All	0.245 (0.267), 0.15	0.197 (0.242), 0.10	0.017 (0.029), 0.003	0.028 (0.034), 0.012	0.019 (0.030), 0.003	0.446 (0.372), 0.4
Excl. protesters	0.238 (0.265), 0.15	0.172 (0.242), 0.075	0.017 (0.029), 0.003	0.027 (0.035), 0.006	0.018 (0.029), 0.003	0.448 (0.380), 0.4
Excl. protesters and irrationals	0.280 (266), 0.175	0.209 (0.255), 0.125	0.021 (0.031), 0.003	0.033 (0.035), 0.015	0.023 (0.031), 0.006	0.515 (0.363), 0.45
Excl. protesters, irrationals, and indifferent at similar risk (main analysis)	**0.299 (0.265), 0.213**	**0.230 (0.260), 0.125**	**0.025 (0.032), 0.005**	**0.035 (0.036), 0.016**	**0.024 (0.032), 0.006**	**0.522 (0.360), 0.45**
Excl. protesters, irrationals, indifferent or choosing Y at similar risk	0.331 (0.263), 0.275	0.286 (0.269), 0.15	0.046 (0.033), 0.04	0.043 (0.035), 0.04	0.036 (0.035), 0.0155	0.582 (0.335), 0.55
Max gamblers (protest[a])	4 % (0 %)	3 % (0 %)	5 % (0 %)	11 % (0 %)	7 % (1 %)	13 % (0 %)
Indifference at first risk presented (protest[b])	18 % (12 %)	18 % (12 %)	10 % (8 %)	11 % (7 %)	7 % (5 %)	12 % (7 %)
Choosing X at similar risk =irrational	14 %	16 %	20 %	16 %	19 %	12 %
Indifferent at similar risk	5 %	7 %	14 %	6 %	7 %	1 %
Choosing Y at similar risk	8 %	14 %	31 %	15 %	25 %	9 %

[a]Respondents responding that they choose Y because “I choose anything because the situation is unreal”.
[b]Respondents responding that they are indifferent because “It doesn’t matter what treatment I get irrespective of the risk in treatment Y”, “I don’t know, I think it is difficult to compare treatments”, or “I choose anything because the situation is unreal”.

Table 7. Mean VSI/VSL (Std.Dev.), median via CV and CA, based on main analysis (in million SEK)

	CV		CA	
Injury	**Estimation**	**Mean estimate**	**Estimation**	**Mean estimate**
Slight 3 months	Risk reduction 100 in 100,000 (50 %)	0.2	Insure for cure at a risk of 2 in 1000	0.3
			Insure for cure at a risk of 10 in 1000	0.1
Moderate 3 months	Risk reduction 30 in 100,000 (50 %)	1.0	Insure for cure at a risk of 1 in 1000	0.8
			Chained via slight	1.0
Moderate 12 months	Risk reduction 30 in 100,000 (50 %)	1.5	Insure for a cure of 1 in 1000	1.0
			Chained via slight	1.3
Severe, permanent	Risk reduction 3 in 100,000 (25 %)	17.5	Chained via slight	12.4
	Risk reduction 6 in 100,000 (50 %)	11.8	Chained via moderate	28.5
Fatal	Risk reduction 1 in 100,000 (25 %)	48.9	Chained via moderate	42.1
	Risk reduction 2 in 100,000 (50 %)	31.9	Indirect chained via slight moderate	58.1
			Indirect chained via slight severe	23.9
			Indirect chained via moderate severe	55.1

Table 8. Relative utility loss based on different types of preference measurements

	VAS[a]	**EQ-5D-5L**[b]	**CV**[c]	**CA**[d]
MRS moderate3m/ MRS slight3m	2.1	2.1 (3.0)	6.0	3.4
MRS severe[e]/ MRS moderate12m (discounted)	25.1	36.5 (54.7)	8.1	9.3-29.4
MRS severe/ MRS moderate12m (undiscounted)	39.6	57.6 (86.4)	8.1	9.3-29.4
MSR fatal/ MRS severe	1.2	1.2 (1.1)	2.7-2.8	1.5

[a]Based on rating by respondents on scale from 0 (worst possible health state) to 100 (best possible health state).
[b]Based on utility weights derived for EQ-5D-5L by mapping from value sets for EQ-5D-3L (van Hout et al. 2012) (derived directly from discrete choice and TTO in a UK sample (Devlin et al. 2016)).
[c]Comparison when keeping risk reduction constant.
[d]Comparison when keeping risk and health state constant.
[e]Weight multiplied by 19 which is the discounted (3.5%) number of expected remaining life-years for the sample.

Table 9. Mean VSI/VSL (Std.Dev.), median via CA, chained on individual estimates (in million SEK)

Injury	Estimation	Estimate 1[a] Incremental risktaking	Estimate 2[b] Absolute risktaking
Moderate 3 months	Chained via slight	1.7 (1.9), 0.8	1.5 (1.6), 0.7
Moderate 12 months	Chained via slight	2.2 (2.4), 1.5	2.0 (2.1), 1.4
Severe, permanent	Chained via slight	37.8 (52.1), 12.5	27.2 (35.6), 10.0
	Chained via moderate	55.1 (74.1), 22.5	25.7 (30.7), 14.5
Fatal	Chained via moderate	163 (214), 47.9	76.9 (97.3), 33.3
	Indirect chained via slight moderate	528 (748), 111.0	320 (430), 81.7
	Indirect chained via slight severe	124 (175), 41.9	83.9 (113), 37.0
	Indirect chained via moderate severe	171 (398), 40.8	79.9 (116), 33.7

[a]Trimmed for outliers according to definition of a box-plot: Moderate 3 months>SEK7.9 million (n=15); Moderate 12 months>SEK12.1 million (n=14); Severe by slight>SEK240 million (n=17); Severe by moderate>SEK351 million (n=28); VSL direct>SEK879 million (n=14); VSL indirect by slight>SEK3069 million (n=22); VSL indirect by moderate>SEK1260 million (n=53).

[b]Trimmed for outliers according to definition of a box-plot: Moderate 3 months>SEK7.3 million (n=15); Moderate 12 months>SEK9.4 million (n=14); Severe by slight>SEK162 million (n=17); Severe by moderate>SEK166 million (n=28); VSL direct>SEK401 million (n=14); VSL indirect slight moderate>SEK1673 million (n=13); VSL indirect by slight>SEK544 million (n=18); VSL indirect by moderate>SEK529 million (n=22).

Table 10. Regression WTP

VARIABLES	CA ln(wtp) all scenarios pooled		CV ln(wtp) all scenarios pooled	
	Excluding zero response	**Including zero response**	**Excluding zero response**	**Including zero response**
ln(age)	-0.0716	-0.100	-0.239	-0.254
	(0.298)	(0.436)	(0.373)	(0.542)
ln((age-mean age)^2)	7.36e-05***	9.21e-05**	7.40e-05	0.000434
	(2.24e-05)	(3.98e-05)	(0.000485)	(0.000676)
Female=1	-0.0602	0.368	0.0211	0.593*
	(0.217)	(0.319)	(0.250)	(0.359)
University education=1	0.0451	0.229	0.0840	0.304
	(0.205)	(0.300)	(0.224)	(0.344)
ln(houshold income per consumption unit)	0.769***	0.590*	0.667**	0.868*
	(0.212)	(0.339)	(0.297)	(0.447)
Car driver at least once a week=1	0.0556	0.317	0.504**	0.386
	(0.239)	(0.355)	(0.245)	(0.377)
Injured due to road traffic accident=1	0.200	-0.211	0.0857	0.0918
	(0.200)	(0.279)	(0.248)	(0.364)
Subjective risk above 4 on scale 1-7=1	0.240	0.946*	0.110	-0.643
	(0.497)	(0.528)	(0.502)	(0.819)
Worry above 4 on scale 1-7=1	0.162	0.528	-0.279	-1.020*
	(0.272)	(0.328)	(0.347)	(0.556)
Control of risk above 4 on scale 1-7=1	0.210	0.264	0.663**	1.121***
	(0.240)	(0.343)	(0.302)	(0.403)
Certainty scale	0.0318		0.0659	
	(0.0415)		(0.0465)	
WTP 2 vs WTP 1	0.178***	0.0759	0.488***	0.467***
	(0.0471)	(0.0867)	(0.0885)	(0.0851)
WTP 3 vs WTP 1	0.439***	0.397***	0.743***	0.684***
	(0.0693)	(0.124)	(0.0982)	(0.0953)
WTP 4 vs WTP 1	0.598***	0.632***	1.009***	0.962***
	(0.0707)	(0.117)	(0.102)	(0.104)
WTP 5 vs WTP 1			1.129***	0.929***
			(0.106)	(0.114)
WTP 6 vs WTP 1			1.040***	0.630***
			(0.124)	(0.147)
WTP 7 vs WTP 1			1.198***	0.642***
			(0.123)	(0.151)
Constant	-2.014	-0.820	-1.843	-4.805
	(2.312)	(3.317)	(3.319)	(4.816)
Observations	834	940	1,271	1,568
R-squared	0.088	0.057	0.133	0.104

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figures

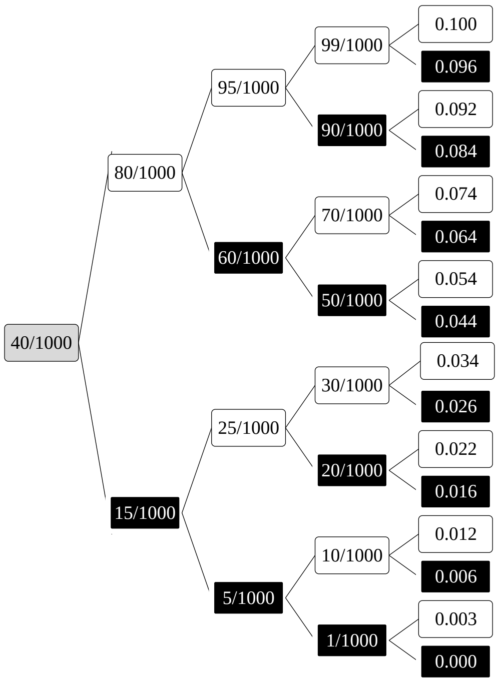

Fig 1. Interval division approach in the SG scenario

Note: Risk of death with treatment Y in the SG question for scenario 3, 4 and 5 (the same approach was applied for scenario 1, 2 and 6, divided by 100 instead of 1,000), grey box = starting point, black box = prefer treatment Y, white box = prefer treatment X, end-nodes = interpreted risk of indifference.

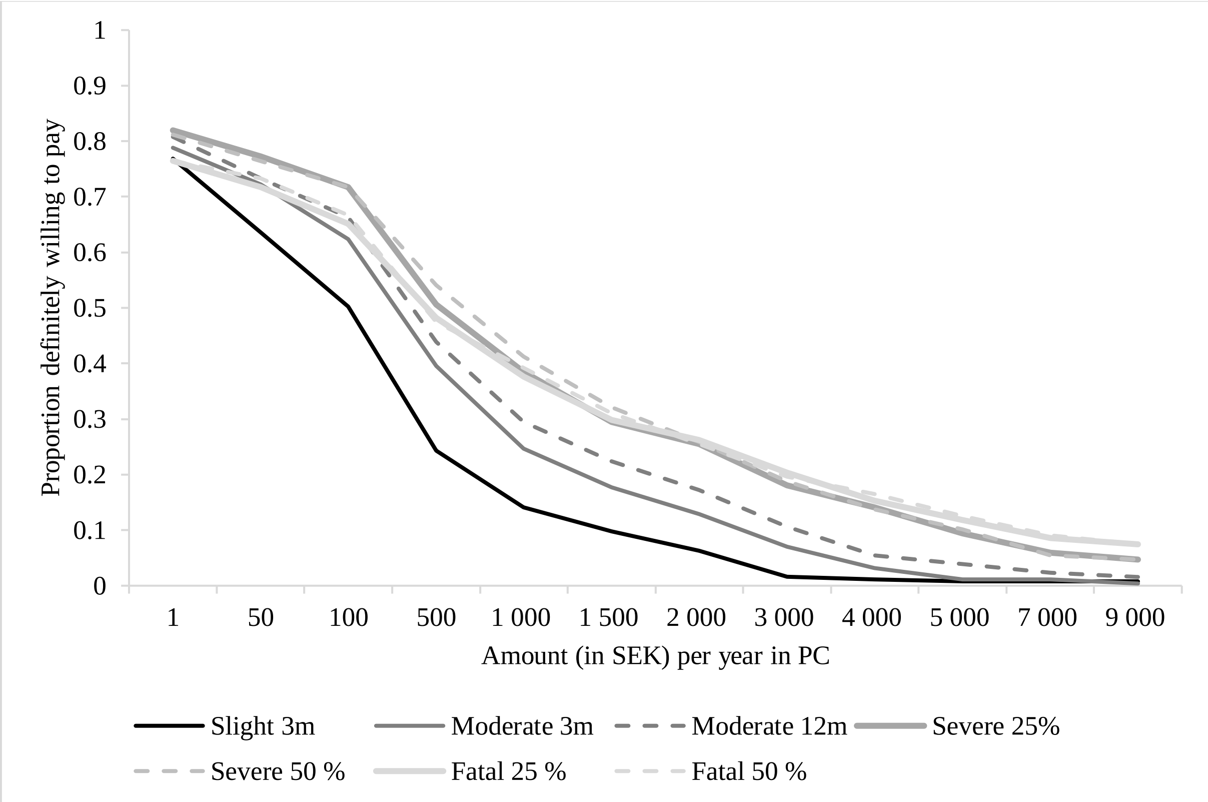

Fig 2. Proportion definitely willing to pay in Payment Card (PC), all respondents in CV

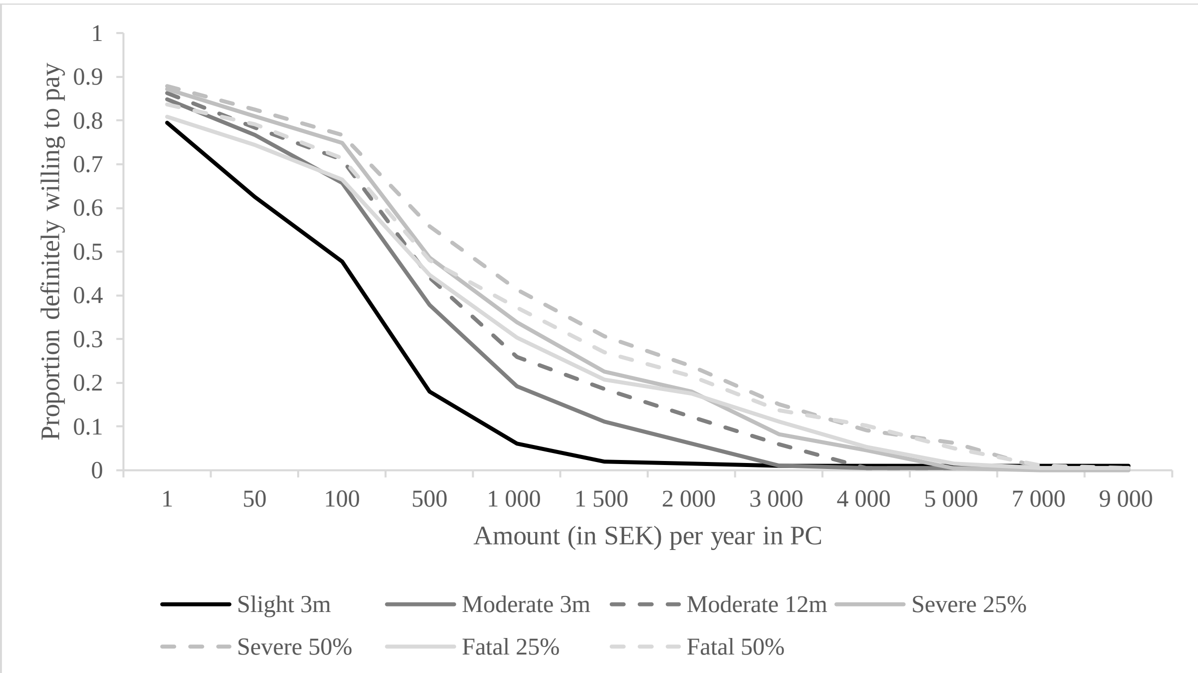

Fig 3. Proportion definitely willing to pay in Payment Card (PC), main analysis in CV

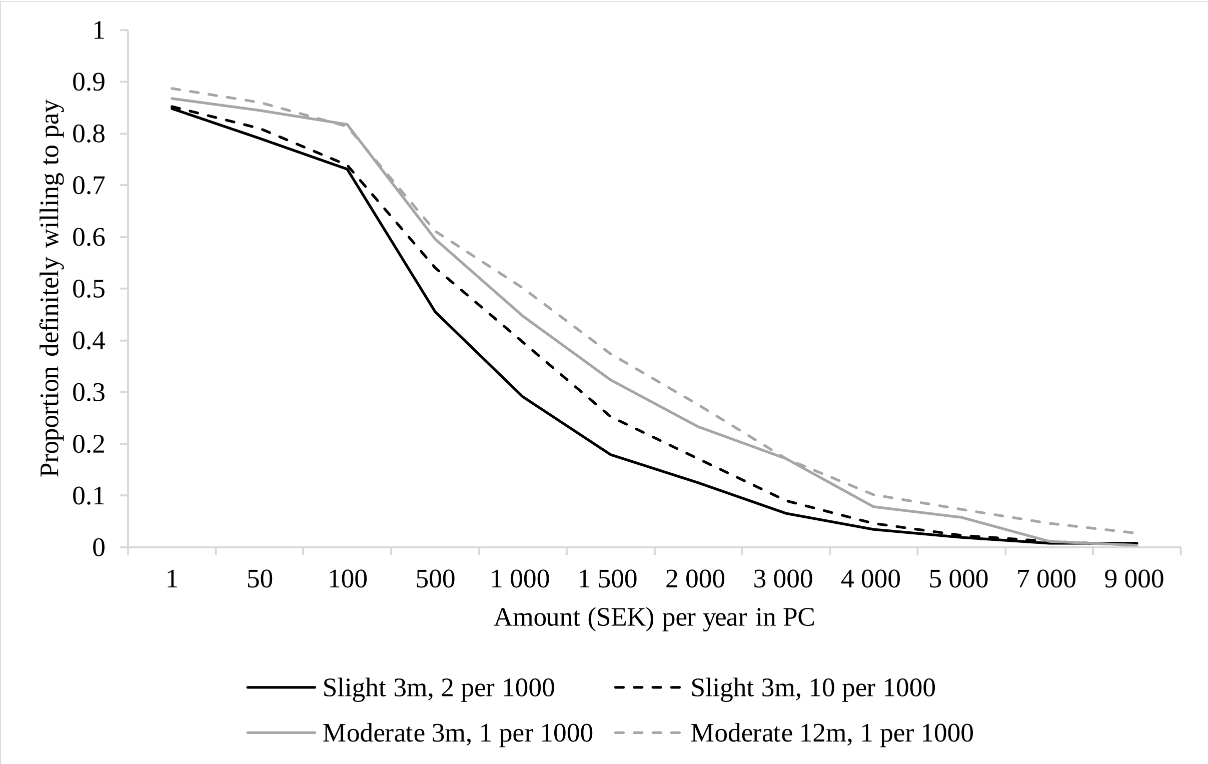

Fig 4. Proportion definitely willing to pay in Payment Card (PC), all respondents in CA

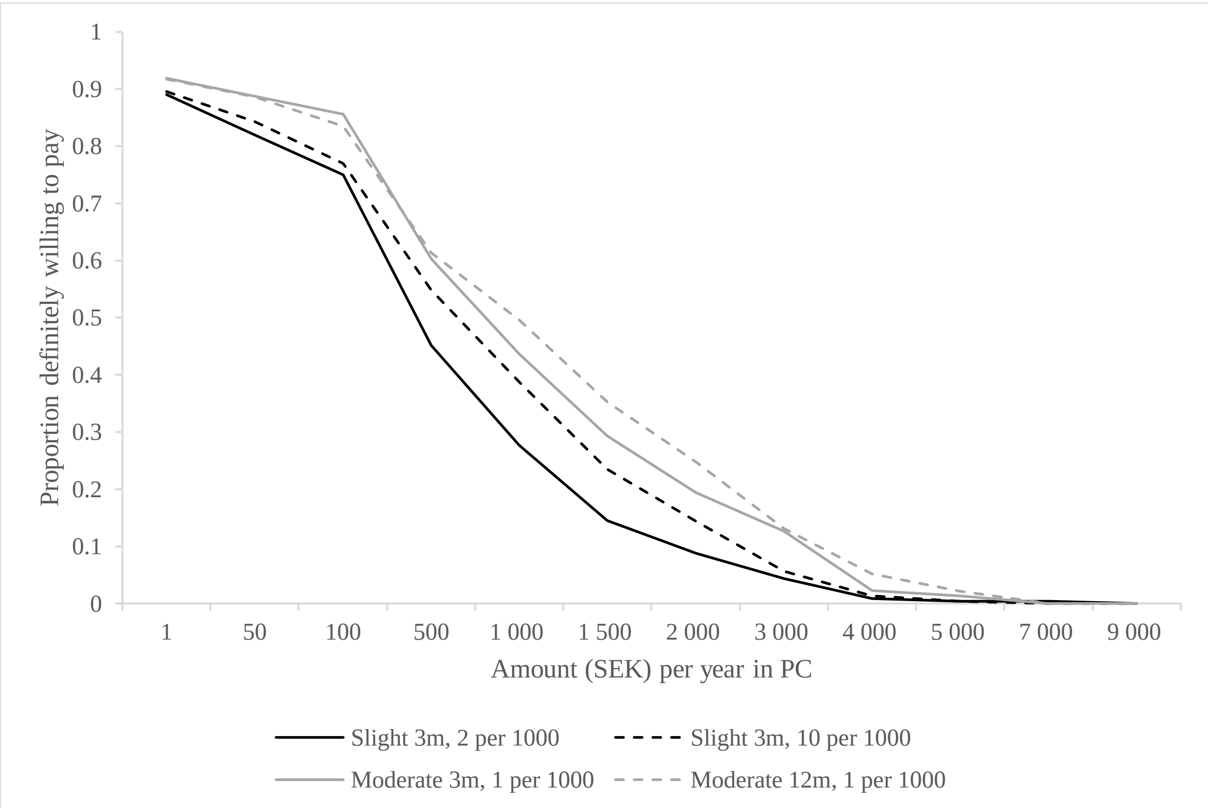

Fig 5. Proportion definitely willing to pay in Payment Card (PC), main analysis in CA

Appendix. Scenarios in questionnaire

Assume that the risk that you will be involved in a less serious road traffic accident that leads to the "yellow" injury is 200 per 100,000.

[A pie chart displaying the risk]

If you are injured, you will receive treatment in the hospital (without overnight stay) and then live with the yellow injury for 3 months before you return to your current health.

Think about what this health state would mean to you:

[A description of the health state and a timeline]

Now imagine that there is a mobile phone application available that reduce the risk of experiencing the road traffic accident by 50 %, to 100 in 100,000.

What is the highest amount you would be prepared to pay to have access to the mobile phone application for one year?

Fig 1. Example of WTP-scenario in CV

Assume that the risk that you will be involved in a less serious road traffic accident that leads to the "yellow" injury is 2 per 1,000.

[1000 dots whereof 2 were colored yellow]

If you are injured, you will receive treatment in the hospital (without overnight stay) and then live with the yellow injury for 3 months before you return to your current health.

Think about what this health state would mean to you:

[A description of the health state and a timeline]

Now imagine that there is an insurance available that would give you access to a treatment that will allow you to return to your current health within a week if you are injured.

What is the highest amount you would be prepared to pay to have access to the insurance for one year?

Fig 2. Example of WTP-scenario in CA

Assume that you have been transported to the hospital after having been involved in a road traffic accident.

Your doctor informs you that there are two different treatments to choose from, which are called treatment X and treatment Y.

You will live with the orange health state for 3 months before you return to your normal health state if the treatments fail.

[A description of the health state and a timeline]

The chance of success with treatment X is high (99 per 100) and means that you will live with the yellow health state for 3 months before you return to your normal health.

[A description of the health state and a timeline]

The chance of success with treatment Y is lower (less than 99 in 100) but means that you will return to your normal health within a week.

Treatment X. Yellow health state for 3 months	**Treatment Y. Uncertain curable treatment**
• You live with the yellow health state for 3 months before you return to your normal health. • The risk of living with the orange health state for 3 months is 1 in 100. [100 dots whereof 99 colored yellow and 1 colored orange]	• You return to your normal health state within a week. • The risk of living with the orang health state for 3 months is X in 100. [100 dots whereof 1-X colored blue and X colored orange]

In this situation, would you prefer treatment X, treatment Y or do you consider them equally good?

Fig 3. Example of SG-scenario in CA

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