Loss aversion in EQ-5D-Y-3L: does it explain differences in willingness to trade-off life duration in adult and child perspectives?

Ava F.H. Hoogenboom, MSc
Stefan A. Lipman, Ph.D.

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Title

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Authors

Ava F.H. Hoogenboom, MSc, Erasmus School of Health Policy & Management (ESHPM)
Stefan A. Lipman, PhD, Erasmus School of Health Policy & Management (ESHPM)

Corresponding author and contact details:
Ava Hoogenboom, hoogenboom@eshpm.eur.nl

Loss aversion in EQ-5D-Y-3L: does it explain differences in willingness to trade-off life duration in adult and child perspectives?

Hoogenboom, A.F.H. (Ava)[a,*] & Lipman, S.A. (Stefan)[a]

[a]Erasmus School of Health Policy & Management, Erasmus University Rotterdam, Rotterdam, the Netherlands

*Corresponding author, E: hoogenboom@eshpm.eur.nl, Burgemeester Oudlaan 50, 3062 PA, Rotterdam

Abstract

Introduction. Earlier work has shown that adults valuing health for 10-year-old children (i.e., in a child perspective) are more reluctant to trade-off life duration than for themselves, generating higher utilities in composite time trade-off (cTTO). The main motivation of this study is to explore if this reluctance can be explained through loss aversion, i.e., losses of life duration weighing more than gains of the same size.

Methods. 100 UK adults completed cTTO tasks for six EQ-5D-Y-3L states and tasks measuring loss aversion. Both sets of tasks were completed from the child perspective and for the respondent themselves, enabling perspective-dependent correction for loss aversion.

Results. A slight majority of participants was explicitly more loss averse for children than for themselves. Health state utilities were higher in the child perspective both before and after correction for loss aversion, with one exception. Differences between utilities elicited in both perspectives and the variance of cTTO utilities increased considerably after correction.

Discussion. The results suggest that loss aversion does not explain differences in willingness to trade-off life duration between perspectives. Hence, it remains unclear if correction for loss aversion should be recommended when using EQ-5D-Y-3L utilities in practice.

1 Introduction

Many countries in the world make policy choices in healthcare based on or informed by economic evaluations (Zorginstituut Nederland, 2016; NICE, 2022, p.66). In these evaluations, the costs and benefits of healthcare interventions are compared to plausible alternatives. Often, the benefits are expressed in terms of quality-adjusted life years (QALYs), which entails weighting life years gained (or lost) through healthcare interventions with 'utilities' (Pliskin, Shepard & Weinstein, 1980) that represent the health-related quality of life in which those years are spent. Utilities are normalized such that being dead has a weight of 0 and full health has a weight of 1.

The standard practice in the Netherlands and many other countries is the use of EQ-5D instruments to elicit utilities for health states (Kennedy-Martin et al., 2020). These questionnaires are designed for patients to self-report their state of health using five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Respondents rate their health on these dimensions using multiple (e.g., 5 for EQ-5D-5L) levels of severity ranging from no problems to extreme problems (EuroQol, n.d.). Utilities can be attached to the EQ-5D health states with the help of previously developed value sets, which collect a countries' general public's preferences for EQ-5D health states for themselves (Versteegh et al., 2016; Devlin et al., 2017; Xie et al., 2016).

Recently, an EQ-5D questionnaire was developed to facilitate decision-making regarding paediatric healthcare. This EQ-5D-Y-3L instrument is an adapted questionnaire recommended for use with children aged 8 to 15. Similar to its adult counterparts, the EQ-5D-Y-3L includes 5 dimensions: mobility, looking after myself, doing usual activities, having pain or discomfort, and feeling worried, sad, or unhappy (EuroQol, 2021). Completing this questionnaire results in a description of the associated health state in numbers. For example, if you rate your health on all dimensions at the lowest level of severity, your health state would be 11111. The EQ-5D-Y-3L has three severity levels, meaning that the health state with the highest severity on all dimensions would be 33333.

Similar to value sets for adult instruments, EQ-5D-Y-3L value sets are constructed from preferences elicited with time trade-off (TTO) tasks and Discrete Choice Experiments (DCE) (Ramos-Goñi et al., 2020). DCE tasks entail choosing between different health states, while TTO tasks ask respondents to consider the amount of life years they are willing to give up to avoid life in some health state and live in full health instead. Whereas for adult EQ-5D instruments these tasks are completed by adults who value hypothetical health states for themselves, for EQ-5D-Y-3L adults are asked to complete these tasks from the perspective of a 10-year-old child.

As such, the perspective used for valuation of EQ-5D-Y-3L differs from that used in adult versions of EQ-5D. The rationale and consequences of this change between what are henceforth referred to as the adult and the child perspective have been a source of ongoing inquiry and discussion (Åström et al., 2022; Dewilde et al., 2022; Kind et al., 2015; Reckers-Droog et al., 2022). Lipman, Reckers-Droog, Karimi, Jakubczyk and Attema (2021) identify two channels to which this could lead to changes in individuals' choices: i) a respondent is now valuing child health states instead of adult health states and ii) a respondent is now valuing somebody else's health state instead of their own. As such, two questions now arise: what happens when people make decisions on behalf of someone else? And, what happens when adults make decisions on behalf of a child?

Some evidence exists suggesting that both channels could affect decision-making. For example, it has already been found that people tend to make riskier choices when a decision concerns another person than when it concerns themselves (Polman & Wu, 2020). In addition, several studies have found that people prioritize healthcare for children over healthcare for adults. Though the reasons why seem to differ across countries and across studies, many researchers have found evidence for preferences for health gains in children over gains in adults (Eisenberg et al., 2011; Ryynanen et al., 1996; Gu et al., 2015; Reckers-Droog, van Exel, & Brouwer, 2019). When focusing on health state valuation in particular, researchers also expect differences when people make decisions from different perspectives (Kreimeier et al., 2018; Shah et al., 2020; Lipman et al., 2021). More specifically, researchers have found differences in TTO valuations between the child and adult perspective. Overall, utilities seem to be higher for the child than for the adult perspective (Kreimeier et al., 2018; Shah et al., 2020; Lipman et al., 2021; Lipman et al., 2022). These differences in utilities have consequences for QALY estimations, which in turn have implications for economic evaluations (Lipman, Reckers-Droog & Kreimeier, 2021).

Several studies have explored why the differences between perspectives exist. Reckers-Droog, Van Exel and Brouwer (2021) found that the willingness to pay for quality-of-life gains of the Dutch public is higher for younger patients (Reckers-Droog, Van Exel & Brouwer, 2021), suggesting that they view child health differently than adult health. A qualitative study by Åström, Conte, Berg and Burström (2022) found people to be reluctant to give up life years when valuing children's health states. "Child life-years are considered more precious" (Dewilde et al., 2022). Hence it seems that the value of life duration may differ between perspectives, with children's life duration being more valuable than adult health. Lipman, Zhang, Shah, and Attema (2022) studied these differences by exploring differences in discounting (i.e., the rate at which health in the future decreases in value relative to health in the present) between both perspectives. If people discount child health differently than their own health, this might explain some of the differences

between the perspectives in TTO tasks. Lipman et al. (2022) in fact found that in both perspectives respondents were inclined to negatively discount health (e.g., they value health in the future more than health now). Moreover, Lang, Attema and Lipman (2023) show that adult-child differences in TTO utilities disappear when correcting for time preference. Yet, Bleichrodt (2002) suggested that in TTO tasks, the value of life duration is not only affected by discounting, but also by a phenomenon called loss aversion. Loss aversion implies that people attach more weight to losses than to gains of the same size, which will yield bias in TTO tasks (Bleichrodt, 2002).

Researchers from various fields have studied loss aversion. For instance, it has been found that people are indeed loss averse when it comes to income (Boyce, Wood, Banks, Clark & Brown, 2013; Brown et al., 2021). Empirical research suggests that loss aversion also affects health state valuation, meaning that people tend to attach more weight to health sacrificed than to potential gains when completing health valuation tasks such as TTO. As a consequence, people are reluctant to sacrifice life duration. When this reluctance is not accounted for, TTO utility weights are biased upwards – meaning that the resulting valuation of health states is higher than it should be (Van Osch et al., 2014; Attema et al., 2015; Lipman, Attema & Versteegh, 2022; Lipman, Brouwer & Attema, 2020).

Earlier work provides some reasons to expect that loss aversion differs between perspectives and thus that loss aversion may explain the differences between the adult and the child perspective. Several researchers have found that loss aversion actually decreases when making decisions on behalf of someone else (Mengarelli et al., 2014; Füllbrunn & Luhan, 2017; Andersson et al., 2016; Polman, 2012). However, as mentioned before, several qualitative studies suggest that when it comes to children, people tend to be reluctant to give up life years (Åström et al., 2022; Dewilde et al., 2022). This unwillingness to sacrifice life duration may be caused by loss aversion (or, alternatively, may be modelled by a measure of loss aversion). At the time of writing, no studies on the effect of loss aversion on EQ-5D-Y-3L valuation exist, which is why this study will focus on exploring whether this could (partly) explain the differences in utilities elicited from the adult and child perspective.

The main motivation of this study therefore is to explore if loss aversion can (partly) explain the differences between health state valuations completed from the perspective of an adult and valuations completed from the perspective of a 10-year-old child when using time trade-off. If differences are indeed found that can (partly) be explained by loss aversion, this would have implications for the utilities derived with the EQ-5D-Y-3L and could suggest that corrections of these utilities are needed (as developed in Lipman, Attema & Versteegh, 2022). The remainder of this paper is structured as follows: the QALY model and the incorporation of loss aversion are

described in the theoretical framework (section 2). Section 3 presents how data was collected and analysed. The analyses and data are shown in the Section 4 and the discussion (Section 5) describes several conclusions and limitations of this study.

2 Theoretical framework

Health state valuation typically assumes that the general QALY model holds (Miyamoto & Eraker, 1988). This model expresses the value of health profiles (T, Q):

$$V(T, Q) = L(T)U(Q) \qquad (1)$$

in which (T, Q) represents living in health status Q for T years. L(T) is the utility associated with the life duration and U(Q) is the utility associated with health state Q.

Although TTO tasks can in principle be completed with any duration, in EQ-5D valuation, TTO tasks involve elicitation of the indifference between 10 years in health state Q and living T years in full health. The value for T is elicited through a series of choices, yielding the following indifference (represented by $\sim$):

$$(10, Q) \sim (T, FH). \qquad (2)$$

In QALY models, it is standard practice to define U(FH) = 1, which means we can derive the utility of health state Q using equation (3):

$$U(Q) = L(T)/L(10) \qquad (3)$$

In practice (i.e., in nearly all applications of TTO), we often assume instead the linear QALY model holds, which implies that L(T)=T, resulting in equation (4):

$$U(Q) = T/10$$
$$(4)$$

These 'standard' TTO questions can only be used for health states that are perceived as better than being dead (BTD states), as for all states worse than dead (WTD) duration T would take a value of 0 (i.e., people prefer not living). If a health state is perceived to be WTD, a lead-time TTO question can be asked to allow for disutility for Q. That is, the task will be focused on eliciting the indifference between living in full health for a period of 10 years followed by a period of 10 years in health state Q (which we denote as $(10, FH; 10, Q)$), and living T years in full health (Lipman et al., 2022):

$$(10, FH; 10, Q) \sim (T, FH) \qquad (5)$$

Using U(FH)=1 and L(T)=T, this leads to the following equation (Lipman, Attema & Versteegh, 2022):

$$U(Q) = (T - 10)/10 \qquad (6)$$

This combination of standard and lead-time TTO questions for BTD and WTD states is called composite TTO (cTTO). Lipman, Attema and Versteegh (2022) present a QALY model based

on prospect theory that incorporates loss aversion (λ) and show how cTTO can be evaluated within that model. In the current study, only those final evaluations (and the intuition underlying them) are reported for the sake of brevity. Any model based on prospect theory requires the definition of a reference-point, which separates gains from losses. Lipman, Attema and Versteegh (2022) assume that in TTO exercises the 10 years in Q serve as the reference-point on which people base their choices, as this is the guaranteed lifetime they compare the alternative (T, FH) with. Life duration sacrificed compared to that reference-point receives an extra weight λ to reflect loss aversion. Formally, we use the same approach and normalisation as Lipman, Attema and Versteegh (2022), which incorporates loss aversion in the general QALY model evaluation of 'standard' TTO indifferences (as in Eq. 2) as follows:

$$U(Q) = \frac{L(T)}{\lambda L(10) + (1-\lambda)L(T)} \tag{7}$$

in which λ denotes the loss aversion coefficient with $\lambda > 1$ characterizing loss aversion (Lipman, Attema & Versteegh, 2022). Note that L(T) here is normalized such that L(20)=1 and L(0)=0, which means that to solve equation (7) we need to measure L(T), L(10) and λ. Earlier work has already explored how the shape of L(T) affects the difference between TTO utilities elicited with an adult and child perspective (Lipman et al., 2022; Lang, Attema & Lipman 2023). Hence, in this paper, we focus only on the effect of loss aversion, and, as such, will (for simplicity) assume that L(T) is linear. We do still maintain the normalisation Lipman et al (2022) applied. As such L(T) is scaled such that L(T) = T/20 and L(10) can be calculated using L(10) = 10/20 (Lipman, Attema & Versteegh, 2022). The appendices of this study illustrate how loss aversion may influence TTO utilities under this normalisation.

For WTD health states, a different approach is needed to incorporate loss aversion. Lipman, Attema and Versteegh (2022) developed two corrections to achieve this. The first correction assumes the reference point such that both sides of the WTD indifference elicitation can be seen as losses (i.e., 10 years in Q and 10 – T years in FH). The second correction is such that respondents experience a loss in lifetime in (*T, FH*) and a gain in lifetime in Q (which is considered negative since it is a WTD health state). In this study, we will use this second approach, as the first approach is not affected by loss aversion. The applied evaluation of indifferences for lead-time TTO (as in Eq. 5) is shown in equation (8).

$$U(Q) = \frac{\lambda(L(T) - L(10))}{1 - L(10)} \tag{8}$$

3 Methods

3.1 Data collection

This study consisted of video interviews (conducted by the first author) with 100 adult participants from the UK that were recruited through Prolific and were awarded a participation fee of around £8.00. The sample size was based on what was feasible for this study and is comparable to other studies (such as Kreimeier et al., 2018)[1]. Before recruitment started, ethical approval was obtained via the ESHPM Research Ethics Review Committee. Participants were asked to sign an informed consent form before proceeding with the interview. Throughout the interview, the interviewer explained the tasks and answered any questions that arose. The interviewer shared her screen with respondents, who stated their answers and preferences verbatim. Since the skills of the interviewer affect the results (Ramos-Goñi et al., 2017), the interviewer completed training and multiple practice interviews before data collection started.

3.1.1 Study design

The interviews were organised in two blocks – a cTTO block and a loss aversion (LA) block. Each respondent completed both blocks from a child perspective (defined as a 10-year-old as is usual in EQ-5D-Y-3L valuation) and from an adult perspective (defined as the respondent themselves). To minimize biases in the responses, the tasks were randomised in three different ways: (1) the order of the blocks was randomised, (2) the order of the child and adult perspective within blocks was randomised, and (3) the order of the six health states that individuals valued within the cTTO block was randomised. The health states that were used differ in severity and were selected from a set of states included in the study by Kreimeier et al. (2018): 11121, 22222, 23321, 32211, 33323, and 33333. These health states intentionally cover all levels of each dimension.

3.1.2 Interview procedure: cTTO block

Before the tasks started, respondents were asked about their age and gender. They were also asked to fill out the EQ-5D-Y-3L. Additionally, they scored their own health on a scale of 0 to 100 (a visual analog scale). In the cTTO block, respondents completed a 'wheelchair' warm-up task based on the procedure outlined in Stolk et al. (2019) before moving on to the actual tasks. The cTTO tasks included a 'sorting' question in which respondents were asked to choose between living in the impaired health state for 10 years or living in full health for 0 years. The remainder of the task was based on a bisection choice procedure for eliciting indifferences; respondents would be asked to imagine living in a described health state, after which they were asked to choose between different scenarios to elicit the indifference $(10, Q) \sim (T, FH)$. The choice started

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[1] Note that EQ-5D value sets (e.g. Versteegh et al., 2016) are typically also elicited with designs in which each included health state is valued by approximately 100 participants.

with equal life durations for both scenarios after which the remaining possible interval was continuously cut in half until the respondent indicated to be indifferent between the two scenarios. This meant that respondents were first asked to choose between $(10, Q)$ and $(10, FH)$. The bisection procedure dictates that choosing $(10, FH)$ would be followed by deciding between $(5, Q)$ and $(10, FH)$, after which the remaining life expectancy was changed again for the following question (i.e., choosing $(5, Q)$ leads to $(2.5, Q)$ versus $(10, FH)$, and choosing $(10, FH)$ leads to $(7.5, Q)$ versus $(10, FH)$). This bisection choice procedure yielded indifferences at a precision of 0.5 years. If a participant indicated that they prefer death over living in the health state in question, the task switched to a lead-time TTO, eliciting indifference $(10, FH; 10, Q) \sim (T, FH)$. An example of a cTTO task is visualised in figure 1a.

3.1.3 Interview procedure: loss aversion block

The non-parametric method was used to measure loss aversion (Abdellaoui et al., 2016). This method can be used to estimate all parameters in prospect theory, but in this study an abbreviated version is used to estimate loss aversion. The method is based on the elicitation of three chained indifferences: 1) a mixed prospect involving both gains and losses, followed by 2) a certainty equivalent in the loss domain (x_1^-), and 3) a certainty equivalent in the gain domain (x_1^+) (Abdellaoui et al., 2016). These elicitations can then be used to estimate loss aversion by combining the utilities for the loss and the gain (Köbberling & Wakker, 2005). In this study, individual-level, perspective-dependent loss aversion coefficients were calculated – with λc indicating a loss aversion coefficient for the child perspective and λa indicating a loss aversion coefficient for the adult perspective. An example of the elicitations can be found in table 1 (Lipman, Attema & Versteegh, 2022). For the first indifference task, G and r were determined a priori (they are set by the experimenter) such that a value for $\mathcal{L}$ can be elicited. Consequently, that value is used as input for the second indifference task, in which the value for loss x_1^- is elicited. In the final indifference task, G is used again to elicit a value for gain x_1^+. Finally, using x_1^- and x_1^+, the loss aversion coefficient λ can be calculated.

Table 1 An example of the non-parametric method in which $x_{0.5}y$ denotes a gamble resulting in x with a probability 0.5 and y otherwise

	General notation	Goal	Example
Indifference 1: Mixed prospect	$G_{0.5}\mathcal{L} \sim r$	Eliciting $\mathcal{L}$	$5_{0.5} - 3 \sim 0$
Indifference 2: Certainty equivalence – losses	$\mathcal{L}_{0.5}r \sim x_1^-$	Eliciting x_1^-	$-3_{0.5}0 \sim -1$
Indifference 3: Certainty equivalence – gains	$G_{0.5}r \sim x_1^+$	Eliciting x_1^+	$5_{0.5}0 \sim 2$

Köbberling & Wakker (2005)	$\lambda = \dfrac{x_1^+}{-x_1^-}$	Loss aversion coefficient	$\lambda = \dfrac{2}{-(-1)} = 2$

The reference-point (r) is used to compare gains and losses to. As stated above equation (7), the reference-point assumed to be of relevance to TTO valuation of EQ-5D instruments is usually 10 years. Several studies have explored other reference-points in TTO and other health preference elicitations (Lipman, Brouwer & Attema, 2020; Van Nooten & Brouwer, 2004; Wouters et al., 2015), though in this study we stick with the commonly used reference-point of 10 years. Respondents were informed that all outcomes in the non-parametric method were added to or subtracted from those 10 years. G was set to 5 such that there was a probability of 0.5 that remaining life expectancy increased by 5 years. That is, the first indifference in this study was designed to derive what amount of life years lost $\mathcal{L}$ would make respondents indifferent between gambling on the 50/50 chance of living 15 extra years ($10 + G$) or living $10 - \mathcal{L}$ life years versus living 10 life years with no extra life years gained ($10 + r$, in which $r = 0$).

In the loss aversion block, tasks were completed to measure λ (designed as in Lipman, Attema and Versteegh, 2022). The warm-up task in this block asked respondents to imagine that they had 10 more years left to live, after which they passed away immediately and painlessly. They were offered two options: option A represented a risky scenario that yielded a 50% chance of gaining an additional 8 years (on top of the promised 10 years) and a 50% chance of losing 8 years (of the promised 10 years), option B meant that respondents gained or lost 0 life years (i.e., they lived the promised 10 years with 100% certainty).

The interviews were organised as follows: the interviewer guided participants through the different tasks, which were visualized using R Shiny. Visualizations can be found in figure 1, and the entire interview interface can be clicked through here: https://referencepoints.shinyapps.io/LossAvarsion/ tasks ended, respondents were asked about their religious beliefs, their parental status, and their educational background.

Figure 1: Visualizations of the interview software

Which life is better a 10-year old child?

Life A — 10 year(s)

Life B — 10 years
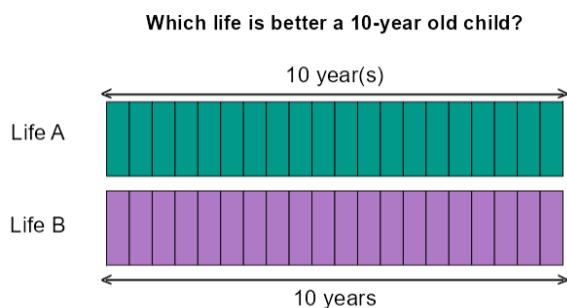
State T:
A lot of problems walking about.
Some problems washing or dressing myself.
Some problems doing my usual activities.
No pain or discomfort.
Not being worried, sad or unhappy.

RESET

1a) Example of a TTO task from the child perspective, in which life A entails living in full health and life B means life in health state T.

Which is better for a 10-year old child?

Choice A

5 | -5
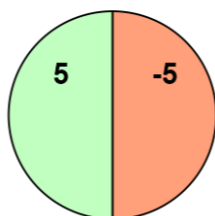
5 year(s) with 50% chance
-5 year(s) with 50% chance

CHOOSE A

Choice B

0

0 year(s) with 100% chance

CHOOSE B

1b) Example of a loss aversion task from the child perspective.

3.2 Data analysis

All data analyses were performed in R. Before starting the main analyses of the results, several data quality controls were performed. Firstly, a descriptive analysis was carried out to get an overview of the respondents' characteristics to ensure that the sample shows a mix in terms of age, gender, level of education and parental status. In addition, the randomisation of perspectives was assessed to review the r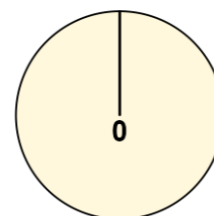isk of bias due to the order in which the tasks were completed. Secondly, given that concerns have been raised about TTO utility data in some publications (Hernandez Alava, Pudney & Wailoo, 2020; Ramos-Goñi et al., 2017), following earlier work (Lipman et al., 2022), the data quality was examined and compared between the perspectives using chi-square tests. This was done by looking at the number of non-trading responses (utility = 1), all-in trading responses (utility = -1), zero responses (utility = 0) and the frequency of unique observations being less than 50% (i.e., fewer than 3 unique values per perspective). Furthermore, the number of respondents without negative values and without 0.5-year increments (as this would suggest low precision) were assessed. Lastly, it was checked how many of the responses showed a violation of weak dominance (e.g., utility of health state 22222≤33333) and how many responses were a strict dominance violation (e.g., utility of health state 22222<33333). The health states included in this study create 15 possible pairs to test dominance violations on[2]. Note that although we refer to these analyses as data quality controls, the occurrence of the respondent patterns summarized above need not imply low quality decision-making (e.g., utilities of 1 may occur due to low task engagement, but also as a result of deliberate and well-reasoned decisions not to sacrifice life duration).

3.2.1 Loss aversion correction

The results of the loss aversion elicitations were used to calculate two different loss aversion coefficients: λa and λc. This was done using the methods described in section 3.1.3. cTTO utilities were rescaled and corrected for loss aversion using equations (7) and (8). In this correction, λa was used for the adult cTTO utilities, and λc was used for the child cTTO utilities. The utilities that result from this correction for loss aversion will henceforth be called 'corrected utilities'. The utilities that result from the interviews and have not been corrected, will be called 'uncorrected utilities' and are based on equations (4) and (6).

3.2.2 Analyses of cTTO utilities

We first report descriptive results of the cTTO utilities, both before and after correction. T-tests were performed to see if any of the health states showed a statistically significant difference

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[2] The potential dominance violations are (denoted as state1<state2 meaning utility of state 1 lower than that of state 2): 11121<32211, 11121<22222, 11121<33323, 11121<33333, 11121<23321, 32211<22222, 32211<33323, 32211<33333, 32211<23321, 22222<33323, 22222<33333, 22222<23321, 33323<33333, 23321<33323, 23321<33333

between adult and child perspectives. The results of these tests are reported alongside the mean uncorrected and corrected utilities. In addition to the means, the differences between the perspectives were calculated per health state. This was done by using individual-level difference scores ($\Delta's$) based on equation (9) to calculate the difference per health state.

$$\Delta c\text{TTO} = cTTO_{A,i} - cTTO_{C,i} \tag{9}$$

Here cTTO$_{A,i}$ denotes the adult cTTO utility for respondent i, and cTTO$_{C,i}$ denotes the child cTTO utility for respondent i.

3.2.3 Regression analyses

Two generalized linear models were constructed: a model with the uncorrected utilities and a model with the corrected utilities. Since the cTTO utilities were skewed (see figure A in appendix I), the data was transformed to fit a gamma distribution. Seeing as gamma transformation only allows zero to positive data, utilities were calculated into disutilities using the following formula (which always have a positive sign):

$$U_T = 1 - U_O$$

in which U_T is the transformed utility (or disutility) and U_O is the original utility value.

The models included fixed effects for the perspective (with adult as the reference category) and for the health states (with 11121 as a reference category) and random effects for the subjects. Furthermore, they also included fixed effects for gender (female being the reference category) and parental status (with no children as the reference category). To further explore the role of loss aversion, separate analyses were conducted for BTD and WTD states. In the latter, 33333 served as a reference category for the health states.

4 Results

4.1 Characteristics of the sample and data quality

The sample consists of a mix of gender and parental status. The respondents were predominantly highly educated. The mean age of the respondents is 39 (12.2) years (SD), with the youngest respondent being 20 and the oldest being 76 years old. Due to a technical error, the age of one respondent is missing in the data. Respondents were generally healthy – the most frequently self-reported health states were 11111 and 11112.

Variable	Stats / Values	Frequency (%)
Table 2. Descriptive statistics of respondents (n=100)		
First perspective[a]	A 10-year-old child	52 (52.0%)
	Yourself	48 (48.0%)
Gender	Female	58 (58.0%)
	Male	41 (41.0%)
	Non-binary	1 (1.0%)
Education[b]	College	17 (17.0%)
	Graduate or professional	29 (29.0%)
	Secondary school	4 (4.0%)
	University Bachelor's degree	48 (48.0%)
	Vocational or similar	2 (2.0%)
Parental status	No	51 (51.0%)
	Yes	49 (49.0%)
Self-reported health (EQ VAS)	*Minimum*	*25*
	Median	*80*
	Maximum	*100*
	Mean	*78 (14.6 SD)*

[a]*The first perspective that the respondent had to complete the valuation tasks from.*
[b]*The highest level of education the respondent completed.*

Table 3 shows an overview of the data quality checks that were performed. The quality checks show some interesting differences between the perspectives, albeit they are not all statistically significant. Looking at the most extreme trading options, there were more non-traders and less all-in traders for the child perspective. In line with the histograms shown in figure 2, table 3 shows more utilities of zero for the child perspective than for the adult perspective. Based on these checks, the data quality seems to be reasonable, though the number of strict violations of dominance in the sample is relatively high (8.86% for the adult and 7.65% for the child perspective). Part of the weak violations of dominance are explained by all-in trading for health states less severe than 33333. That is, 26 occurrences in the adult and 21 in the child

perspective were the result of health states less severe than 33333 being valued at the lowest possible utility of -1, leaving no room for dominance of health state 33333.

Table 3. Data quality per perspective

| Response pattern	Adult perspective	Child perspective
Non-trading responses (U=1) *(n=598)*	21	24
All-in trading responses (U=-1) *(n=598)*	**43**	**26**
Zero responses (U=0) *(n=598)*	**12**	**26**
Fewer than 3 out of 6 unique observations[a] *(n=100)*	1	7
Respondents without negative utilities *(n=100)*	47	53
Respondents without 0.5-year increments *(n=100)*	5	8
Weak violation of dominance (e.g., 22222 ≤ 33333) *(n=1,490)*	303	340
Strict dominance violation (e.g., 22222<33333) *(n=1,490)*	132	114

[a]*Respondents that gave the same value to all health states, or that had only 2 unique valuations.*

Bold-faced analyses indicate that chi-square tests were significant (p<0.05)

4.2 Correcting for loss aversion

The distributions of the loss aversion coefficients were skewed with some outliers at very high values due to some respondents' unwillingness to take any sort of gamble when it comes to life years (e.g., loss aversion coefficients of 25). Such large coefficients for loss aversion would strongly affect TTO utilities after correction. To improve the data analysis and minimize the effect of these outliers, they were altered by capping the loss aversion coefficients at a maximum value of 5 (specified as $\lambda \leq 5$). This led to 3 values being censored for the adult perspective, and 9 for the child perspective. It is worth noting that the highest coefficient in the child perspective was almost three times greater than the highest value for the adult perspective. Figure 2 reports the distribution of the coefficients after capping them. For the sake of completeness, the same analyses were performed without censoring the data. These analyses can be found in the appendices of this paper – the conclusions of all of the following analyses remain largely unchanged.

Figure 2: Individual-level loss aversion coefficients (λ) from the adult and child perspective
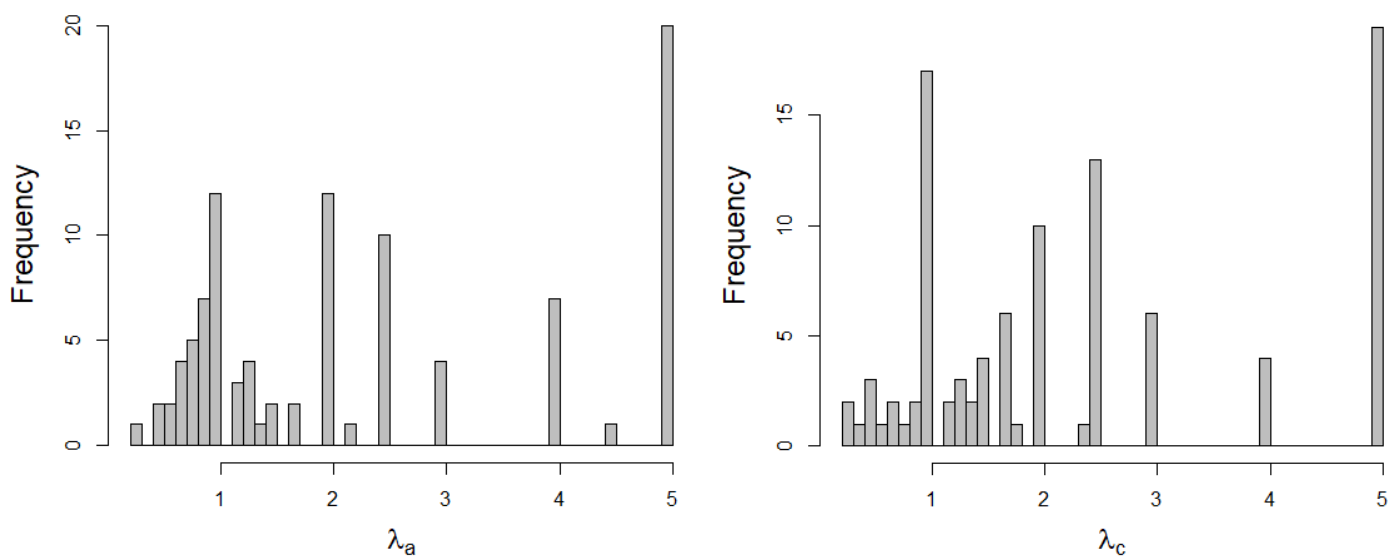
2a) Loss aversion coefficients from the adult perspective   *2b) Loss aversion coefficients from the child perspective*

Table 4 reports the loss aversion coefficients with and without data censoring. Without censoring, there seems to be a difference in loss aversion between the adult and the child perspective. When removing outliers by censoring the loss aversion data, this difference disappears. The standard deviation shows a strong decrease after censoring the child perspective loss aversion coefficients, which is in line with the occurrence of more outliers in this perspective

and the difference in magnitude of the outliers between the perspectives. In any case, the difference between perspectives is not statistically significant (p=0.197 with no censoring, p=0.751 with $\lambda \leq 5$, based on T-tests). Analysis on the individual-level loss aversion coefficients without data censoring also shows mixed results: 40 respondents seem to be explicitly more loss averse for themselves than for children (λa > λc), 11 respondents are equally loss averse for themselves and for children (λa = λc), and 49 respondents are explicitly more loss averse for children than for themselves (λa < λc).

Table 4. Loss aversion coefficients (st.dev.) with and without censoring

	Adult		Child	
Method	*Mean (st.dev.)*	*Median*	*Mean (st.dev.)*	*Median*
No censoring	2.17 (1.66)	1.83	2.61 (3.02)	2.0
$\lambda \leq 5$	2.39 (1.62)	2.0	2.34 (1.53)	2.0

4.3 cTTO utilities

Table 5 shows the mean uncorrected and the mean corrected utilities of each health state, specified for both perspectives. For the uncorrected utilities, health states 32211, 23321, and 33323 show a statistically significant difference between the adult and the child perspective, with the child perspective yielding higher utility. For the corrected utilities, only health state 23321 is significantly different between perspectives. Overall, some trends can be seen in the utilities. For the uncorrected utilities, 5 out of 6 health states (i.e., 32211, 22222, 23321, 33323, and 33333) show higher utility from a child perspective than from an adult perspective. After correcting for loss aversion with $\lambda \leq 5$, the utilities for the child perspective are higher for all health states. After correction, all utilities decrease. Table 5 also shows that the absolute differences (Δ) between perspectives per health state increase after correction. Combined with the increasing standard deviations, this suggests that correction decreases mean cTTO utility estimates and increases the heterogeneity of these estimates.

Table 5. Mean (standard deviations) cTTO utilities for all states per perspective and the differences between perspectives with data censoring (LA ≤ 5)

	Uncorrected utilities		Corrected utilities		Differences between perspectives	
State	TTO-A	TTO-C	TTO-A	TTO-C	Δ Uncorrected	Δ Corrected
11121	0.86 (0.16)	0.86 (0.16)	0.78 (0.19)	0.79 (0.20)	-0.002	-0.006
32211	0.63 (0.36)*	0.71 (0.32)*	0.37 (1.21)	0.56 (0.55)	-0.086	-0.196
22222	0.61 (0.36)	0.62 (0.36)	0.36 (1.12)	0.43 (0.71)	-0.011	-0.068
23321	0.46 (0.53)*	0.59 (0.43)*	0.01 (1.69)*	0.33 (0.93)*	-0.132	-0.326
33323	0.03 (0.62)*	0.14 (0.61)*	-0.83 (2.16)	-0.69 (2.01)	-0.113	-0.142
33333	-0.18 (0.62)	-0.1 (0.59)	-1.80 (2.73)	-1.42 (2.54)	-0.082	-0.385

* Indicates that the within-subject difference between the adult and child valuations was significant (T-test, p<0.05).

4.4 Regression results

Table 6 shows the first two generalized linear models. The models are based on both uncorrected and corrected disutilities. Model 1 was computed without including any demographic characteristics. Model 2 includes gender, parental status, highest completed level of education (for which college is the reference category) and the order of the perspectives during the tasks as additional variables. Both models use state 11121 as a reference category for the state dummies. Both model 1 and 2 report a statistically significant difference between the child and adult perspective at the 99% significance level for the uncorrected utilities and 95% for the corrected utilities. In line with the results in Table 5, disutilities are lower from the child perspective (that is, for the same health state utility is higher from the child perspective than the adult perspective).

Adding demographic characteristics to the model slightly increases the adjusted R-squared and therefore marginally improves the model's explanatory power. Before correcting for loss aversion, having kids and a vocational educational level significantly impact cTTO utilities (i.e., having kids results in higher cTTO utilities and vocational education results in lower cTTO utilities). After correcting for loss aversion, the statistical significance of these effects disappears. However, a new correlation appears – secondary school is associated with higher utilities.

Table 6. Generalized linear models (gamma distribution) of disutilities for health states from the adult and child perspective with and without demographics (*n=1169*)

term	Model 1		Model 2	
	Uncorrected disutilities	Corrected disutilities	Uncorrected disutilities	Corrected disutilities
	Estimate (SE)	*Estimate (SE)*	*Estimate (SE)*	*Estimate (SE)*
(Intercept)	0.19 (0.04) ***	0.31 (0.12) *	0.12 (0.06)	0.17 (0.22)
State 32211	0.20 (0.05) ***	0.32 (0.16) *	0.20 (0.05) ***	0.32 (0.16) *
State 22222	0.25 (0.05) ***	0.38 (0.16) *	0.25 (0.05) ***	0.38 (0.16)
State 23321	0.34 (0.05) ***	0.61 (0.16) ***	0.34 (0.05) ***	0.62 (0.16) ***
State 33323	0.78 (0.05) ***	1.55 (0.16) ***	0.78 (0.05) ***	1.55 (0.16) ***
State 33333	1.01 (0.05) ***	2.39 (0.16) ***	1.01 (0.05) ***	2.39 (0.16) ***
Child perspective	-0.07 (0.03) **	-0.19 (0.09) *	-0.07 (0.03) **	-0.19 (0.09) *
Gender: Non-male	-	-	-0.01 (0.03)	0.07 (0.09)
Kids: yes	-	-	-0.06 (0.03) *	-0.10 (0.09)
Secondary school	-	-	-0.12 (0.07)	-0.56 (0.25) *
Vocational or similar	-	-	0.23 (0.10) *	-0.66 (0.35)
University Bachelor's degree	-	-	0.03 (0.04)	-0.03 (0.13)
Graduate or professional degree	-	-	0.06 (0.04)	0.02 (0.14)
Order of perspectives	-	-	0.04 (0.03)	0.13 (0.09)
Adjusted R-squared	0.371	0.2162	0.3792	0.2207
AIC	1525.2	4495.7	1516.6	4495.8

***p<0.001,**p<0.01,*p<0.05

Table 7 shows two generalized linear models that separate BTD and WTD cTTO utilities. In the WTD model, health state 33333 serves as a reference category for the health state dummies. Model 3 (BTD only) shows that the disutilities increase (utilities decrease) in accordance with health state severity. In model 3, both before and after correction, the effect of perspective significantly impacts cTTO utilities (i.e., $p<0.05$ before correction and $p<0.01$ after correction). Model 4 (WTD only) shows that the effect of perspective on cTTO utilities is no longer statistically significant after correcting for loss aversion. Nonetheless, model 4 shows that correction causes a strong decrease in WTD disutility values, which explains the steep increase in absolute differences between perspectives described in table 5. Note that none of the fixed effects for health states are significant, indicating that differences with the utility of state 33333 are not significant. In addition, the intercept and the standard errors are significantly higher for the WTD health states compared to the BTD health states. Based on the adjusted R-squared, the explanatory power is also much lower for the WTD model, especially for the corrected cTTO disutilities.

Table 7. Generalized linear models (gamma distribution) that separate BTD and WTD disutilities for six different health states from the adult and child perspective with data censoring

term	Model 3: BTD only *(n=1000)*		Model 4: WTD only *(n=196)*	
	Uncorrected disutilities	Corrected disutilities	Uncorrected utilities	Corrected utilities
	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
(Intercept)	0.15 (0.02) ***	0.24 (0.02) ***	1.73 (0.04) ***	4.79 (0.30) ***
State 32211	0.14 (0.02) ***	0.17 (0.02) ***	-0.04 (0.11)	-0.43 (0.91)
State 22222	0.19 (0.02) ***	0.22 (0.02) ***	-0.04 (0.10)	-0.59 (0.86)
State 23321	0.20 (0.02) ***	0.24 (0.02) ***	0.05 (0.07)	-0.51 (0.61)
State 33323	0.41 (0.02) ***	0.44 (0.03) ***	0.04 (0.05)	-0.40 (0.40)
State 33333	0.49 (0.03) ***	0.51 (0.03) ***	-	-
Child perspective	-0.03 (0.01) *	-0.05 (0.02) **	-0.09 (0.04) *	-0.37 (0.35)
Adjusted R-squared	0.316	0.3087	0.007561	-0.01182
AIC	-136.05	-12.303	83.829	917.53

***p<0.001,**p<0.01,*p<0.05

5 Discussion

The main motivation of this study was to explore the extent to which loss aversion could explain differences in cTTO utilities elicited with adult and child perspectives. Overall, the results of this study suggest that differences in the degree of loss aversion for adults versus children do not explain the differences in cTTO utilities between the perspectives. When looking at the utilities per health state, we replicate results shown in earlier work. That is, there seem to be differences between utilities elicited from an adult and from a child perspective (Lipman et al., 2022; Kreimeier et al., 2018; Shah et al., 2020; Lipman et al., 2021). Our work shows a trend for children's health states to yield higher utility than adult health states. The magnitude of the differences differs between studies (Lipman et al., 2022; Kreimeier et al., 2018; Shah et al., 2020). Furthermore, it is worth noting that the models on the WTD data show that utility does not differ significantly between 33333 and other WTD states, replicating earlier work that questions the sensitivity of cTTO for WTD health states (Jakubczyk, 2023; Gandhi, Rand & Luo, 2019).

We observed some differences in loss aversion when comparing adult and child perspectives. Loss aversion showed large heterogeneity for children vis-à-vis adults, but there was no mean difference – the individual-level mean loss aversion coefficient was 2.39 (1.62 SD) for the adult and 2.34 (1.53 SD) for the child perspective. These coefficients are in line with a meta-analysis by Brown et al. (2021). The absence of a mean difference suggests that loss aversion is a consistent phenomenon that is independent of perspective, which is in line with earlier research into loss aversion by Lipman, Brouwer and Attema (2018), who found loss aversion to, on average, be independent of the severity of the health states considered. Interestingly, studies into loss aversion for monetary outcomes find contrasting results. For instance, Mengarelli et al. (2014) showed that loss aversion reduced when making a monetary choice for another person compared to making the choice for themselves. When deciding whether to enter lotteries, people seem to be less loss averse when it comes to making financial decisions for others if the decision bears no consequences for themselves (Füllbrunn & Luhan, 2017). Polman (2012) drew the same conclusion – people are less loss averse when making decisions for others compared to making decisions for themselves – when it comes to riskless choice, gambling, and social factors. The absence of the same difference for health-related questions suggests that health may be an exception to this behaviour. Several researchers find evidence that supports this suggestion. For example, Pachur, Hertwig and Wolkewitz (2014) indeed found that people have different preferences for 'affect-poor' (e.g., monetary) and 'affect-rich' (e.g., health-related or amenity-related) choice tasks. Future research should be focused on further investigating whether health is unique when it comes this kind of choice behaviour – for example,

by exploring within-subject differences in choice behaviour regarding monetary matters versus health-related decisions.

The analyses on correcting for loss aversion showed that, as reported in previous work (Lipman, Attema & Versteegh, 2022), correction decreased utilities. Our work adds to this literature that this downward effect of correction occurs in both perspectives, and (particularly for WTD states) increases heterogeneity. The generalized linear models in this paper demonstrate two things: (1) in health states considered to be better than dead, loss aversion does not explain the difference in cTTO utilities between the adult and the child perspective, and (2) at face value, in health states considered to be worse than dead, differences between perspectives are no longer systematic after correcting for loss aversion. Given that the model lacks explanatory power and that WTD health states show the highest increased deltas after correction, the lack of systematic differences rather suggests increased noise than loss aversion playing some role in the differences between perspectives. In all models, the corrections are accompanied by increased error – the mean absolute differences between perspectives and the utilities' standard deviations/errors tend to increase – due to uncertainty in the loss aversion estimates.

As far as we know, no other studies on health-related loss aversion from the adult and child perspective have been done, which complicates comparison with existing literature. Nevertheless, several qualitative studies found people to be reluctant to trade-off life years for children (Åström et al., 2022; Dewilde et al., 2022). This study was motivated by the notion that (the underlying causes for) this reluctance may correlate with people showing more loss aversion for children, since the same underlying principles play a role in loss aversion tasks. Nevertheless, our study provides no evidence in favour of this reasoning, as we find no consistent evidence to suggest that differences between the perspectives disappear after correction.

5.1 Limitations

This study has several limitations. The most apparent limitation is the singular focus on loss aversion and consequently ignoring potential other mechanisms. For example, a limitation that might explain our null result is the assumption of utility being linear. To illustrate: Lang, Attema & Lipman (2023) found that the difference between the adult and the child perspective can be partly explained by differences in time preference (i.e., nonlinearity of utility) – they state that the adult-child differences disappear when correcting cTTO utilities for time preference. Furthermore, the need to censor the loss aversion coefficients might indicate that the loss aversion task is influenced by other behaviours – for instance by (un)willingness to gamble – hence affecting its ability to explain or capture unwillingness to trade-off life duration.

Another limitation could be the difference in the length of the scale that utilities are reported from before and after correction. Before correction the utilities lie between -1 and 1, whereas after correction, the assumption of linearity is dropped and the lower limit of -1 disappears. As a result, the corrected utilities show outliers far below -1. As pointed out in existing literature, these exceptionally low utility scores may pose issues when using them in cost-effectiveness analyses (Tilling et al., 2010). However, there seems to be little to no basis for using a lower limit of -1 (Tilling et al., 2010), since this limit is arbitrary and is an artefact of the valuation method used (Lipman, Attema & Versteegh, 2022). Though transforming utility data to fit this limit simplifies data analysis, it may also mean that, when looking at life duration, utilities of BTD and WTD states can no longer be compared on the same scale, which complicates their use for QALY computation and ultimately cost-effectiveness analyses.

A final limitation of this study is the reference-point that is used in the corrections. It appears individual's expectation about length of life in particular could serve as a reference-point (Lipman, Brouwer & Attema, 2020). The effect associated with such subjective life expectancies is that people are reluctant to trade-off years that are below the number of years they thought they had left to live. For example, if people expect to live for another 50 years and you ask them to trade-off 10 years, people are more reluctant to give up life years than if you would ask them to trade-off 70 years. For the child perspective, this may mean that the life expectancy people expect a child to have influences the way they value health states on behalf of children. The correction for loss aversion in this study is based on a reference-point of 10 years. Existing research has found mixed results; some studies found that the reference-point does not have any effect (Lipman, 2022), others find that it does (Van Nooten & Brouwer, 2004; Van Nooten, Koolman & Brouwer, 2009). If subjective life expectancy would serve as the reference-point instead of the assumed 10 years, that would mean that the corrections that are carried out in this study are incorrect.

5.2 Conclusions

Overall, this study shows that loss aversion cannot explain perspective-dependent differences in utilities elicited with adult and child perspectives. In fact, our findings somewhat caution against correcting for (only) loss aversion: although loss aversion has been argued to cause bias in cTTO, the increased error that accompanies correction of cTTO utilities for loss aversion seems undesirable. At face value our results suggest that correcting bias related to loss aversion may even increase differences between utilities elicited adult and child perspectives, potentially exacerbating the effects these differences could have on ICERs. That is, when utilities elicited with adult EQ-5D instruments and adult perspectives, are compared to those elicited with EQ-5D-Y-3L instrument, the perspective used in the latter instrument may influence the outcome of the

comparison. Whether or not this is desirable ultimately depends on the causes of these differences. For example, they could be desirable if they reflect true differences in (the perception of) health state severity (as discussed by Devlin et al., 2023), and/or the potential effects on reimbursement decision-making are in line with societal preferences (something that might be improved using equity weights, as suggested by Attema, Lang & Lipman, 2023). Therefore, although our study provides no evidence for loss aversion as one of these explanations, further research into other causes of differences between the adult and the child perspective and their potential consequences for reimbursement decisions remains relevant.

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Appendices

Appendix I – Distribution of cTTO data

Histograms were computed to visualize the distribution of the values the respondents assigned to the health states. Figure a) shows a histogram of all cTTO utilities that were elicited during the interviews. The utilities are skewed to the right, with higher utilities occurring more frequently. In figure b) and c), the utilities are reported per perspective.
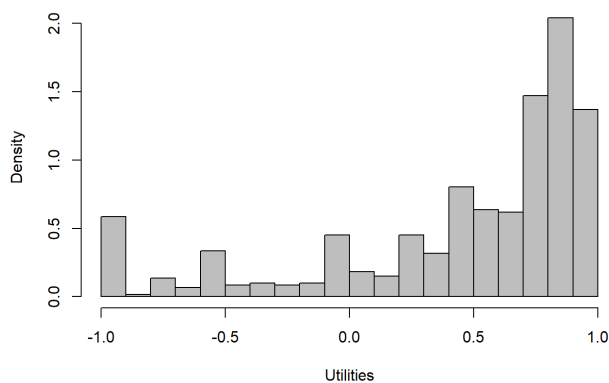
Figure: cTTO utilities
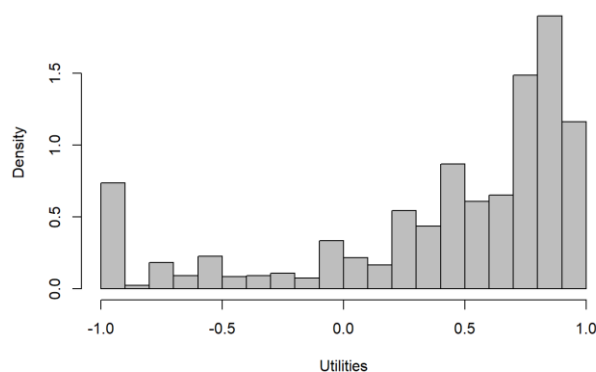
a) All cTTO utilities
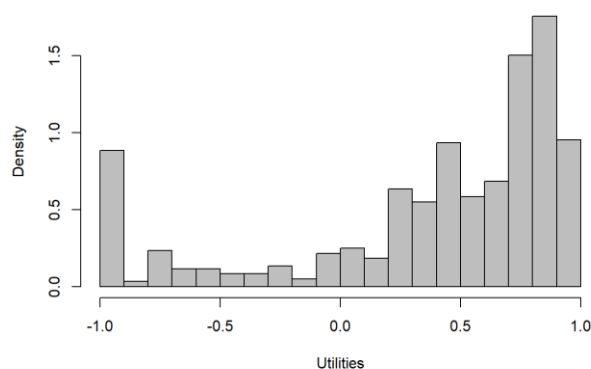
b) cTTO utilities from the adult perspective

c) cTTO utilities from the child perspective

Appendix II – The effect of loss aversion on TTO utilities

The main motivation for measuring loss aversion in this research paper lies in the hypothesis that differences in utilities between the adult and the child perspective may reflect differences in loss aversion. In other words, people may be more unwilling to give up life duration for children than for adults (relative to gaining life duration), which may be reflected in a higher λ. If people are more loss averse for children than for adults, this would yield different values for λ in equation (7), which in turn would result in different utility values for the same health states. We will illustrate how loss aversion affects TTO by showing its effect on the resulting sacrificed life duration and by showing its effect on utility, given that we assume equal sacrificed life duration to calculate utilities.

EFFECT OF LOSS AVERSION ON T

Imagine a person that is not loss averse for adults but is loss averse for children with $\lambda = 2$.

Assume U(Q)=0.5 and $\lambda = 1$ (i.e., no loss aversion). Using the aforementioned scaling approach and equation (7), this yields:

$0.5 = \frac{T/20}{1*(10/20)+(1-1)(T/20)}$, which with $\lambda = 1$ gives:

0.5 = (T/20) / 0.5

$T/20 = 0.25 \rightarrow T = 5$

Now, we incorporate $\lambda = 2$:

$0.5 = \frac{T/20}{2*(10/20)+(1-2)(T/20)}$, which simplifies to

$0.5 = \frac{T/20}{1-(T/20)}$,

$0.5 = -1 + \frac{1}{1-(T/20)}$

$T/20 = 1 - \frac{1}{0.5+1}$

$T = 6.667$

This example illustrates that for this person, for whom loss aversion is stronger for children than for adults, giving up less life years for children (vs. adults) results in the same utility. In other words, different loss aversion coefficients for adults and children lead to different life duration sacrifices for the same health state.

EFFECT OF LOSS AVERSION ON UTILITY

Assume T=5 and $\lambda = 1$ (i.e., no loss aversion as in Eq. 3):

$U(Q) = \frac{(5/20)}{(10/20)} = 0.5$

Now assume T=5 and $\lambda = 2$:

$$U(Q) = \frac{5/20}{2*(10/20)+(1-2)(5/20)}$$

$$U(Q) = \frac{0.25}{1-0.25} = 0.333$$

This example shows that differences in loss aversion yield different utilities for children than for adults for the same health state and the same life duration sacrificed. In particular, it shows that correcting for loss aversion generally yields lower utilities.

Appendix III – Data without censoring

Table A. Mean (standard deviations) cTTO utilities for all states per perspective and the differences between perspectives without data censoring

	Uncorrected utilities		Corrected utilities		Differences between perspectives	
State	TTO-A	TTO-C	TTO-A	TTO-C	Δ Uncorrected	Δ Corrected
11121	0.86 (0.16)	0.86 (0.16)	0.79 (0.20)	0.78 (0.21)	-0.002	0.01
32211	0.63 (0.36)*	0.71 (0.32)*	0.38 (1.22)	0.56 (0.55)	-0.086	-0.179
22222	0.61 (0.36)	0.62 (0.36)	0.39 (1.13)	0.43 (0.71)	-0.011	-0.043
23321	0.46 (0.53)*	0.59 (0.43)*	0.03 (1.69)	0.33 (0.93)	-0.132	-0.304
33323	0.03 (0.62)*	0.14 (0.61)*	-0.79 (2.13)	-0.79 (3.13)	-0.113	0.007
33333	-0.18 (0.62)	-0.1 (0.59)	-1.63 (2.55)	-1.62 (3.86)	-0.082	-0.013

* Indicates that the within-subject difference between the adult and child valuations was significant (T- test, $p<0.05$).

Table B. Generalized linear models (gamma distribution) of BTD disutilities for health states from the adult and child perspective without data censoring (*n=1000*)

	Model 1: uncorrected utilities	Model 2: corrected utilities
term	Estimate (SE)	Estimate (SE)
(Intercept)	0.15 (0.02) ***	0.23 (0.02) ***
State 22222	0.19 (0.02) ***	0.22 (0.02) ***
State 23321	0.20 (0.02) ***	0.23 (0.02) ***
State 32211	0.14 (0.02) ***	0.16 (0.02) ***
State 33323	0.41 (0.02) ***	0.45 (0.03) ***
State 33333	0.49 (0.03) ***	0.51 (0.03) ***
Child perspective	-0.03 (0.01) *	-0.03 (0.02)
Adjusted R-squared	0.316	0.3065

***p<0.001,**p<0.01,*p<0.05

Table C. Generalized linear models (gamma distribution) of BTD disutilities for health states from the adult and child perspective including demographics without data censoring (*n=1000*)

term	Model 1: uncorrected utilities Estimate (SE)	Model 2: corrected utilities Estimate (SE)
(Intercept)	0.21 (0.03) ***	0.29 (0.04) ***
State 22222	0.19 (0.02) ***	0.22 (0.02) ***
State 23321	0.20 (0.02) ***	0.23 (0.02) ***
State 32211	0.14 (0.02) ***	0.16 (0.02) ***
State 33323	0.41 (0.02) ***	0.44 (0.03) ***
State 33333	0.49 (0.03) ***	0.51 (0.03) ***
Child perspective	-0.03 (0.01) *	-0.03 (0.02)
Gender: non-male	-0.03 (0.01)	0.01 (0.02)
Kids: yes	-0.05 (0.01) ***	-0.05 (0.02) **
Graduate or professional degree	-0.02 (0.02)	-0.11 (0.02) ***
Secondary school	-0.04 (0.04)	-0.14 (0.04) ***
University Bachelor's degree	-0.03 (0.02)	-0.10 (0.02) ***
Vocational or similar	-0.08 (0.05)	-0.09 (0.05)
Perspective order	0.01 (0.01)	0.03 (0.02)
R-squared	0.3239	0.3306

***p<0.001,**p<0.01,*p<0.05

Table D. Generalized linear models (gamma distribution) of WTD disutilities for health states from the adult and child perspective without data censoring (*n=169*)

term	Model 4: uncorrected utilities Estimate (SE)	Model 5: corrected utilities Estimate (SE)
(Intercept)	1.73 (0.04) ***	4.63 (0.43) ***
State 22222	-0.04 (0.10)	-0.70 (1.24)
State 23321	0.05 (0.07)	-0.55 (0.87)
State 32211	-0.04 (0.11)	-0.52 (1.31)
State 33323	0.04 (0.05)	-0.39 (0.58)
Child perspective	-0.09 (0.04) *	0.12 (0.51)
Adjusted R-squared	0.007561	-0.02127

***p<0.001,**p<0.01,*p<0.05

Table E. Generalized linear models (gamma distribution) of WTD disutilities health states from the adult and child perspective including demographics without data censoring (*n=169*)

term	Model 4: uncorrected utilities Estimate (SE)	Model 5: corrected utilities Estimate (SE)
(Intercept)	1.89 (0.10) ***	6.51 (0.85) ***
State 22222	-0.02 (0.10)	-0.39 (0.92)
State 23321	0.05 (0.07)	-0.43 (0.63)
State 32211	-0.04 (0.11)	-0.32 (0.95)
State 33323	0.04 (0.05)	-0.35 (0.42)
Child perspective	-0.10 (0.04) *	-0.35 (0.42)
Gender: Non-male	0.02 (0.05)	-0.20 (0.41)
Kids: yes	0.02 (0.05)	0.06 (0.43)
Graduate or professional degree	-0.02 (0.07)	-1.27 (0.62) *
Secondary school	-0.36 (0.18) *	-3.01 (1.57)
University Bachelor's degree	-0.06 (0.07)	-1.31 (0.59) *
Order	-0.09 (0.05)	-0.37 (0.42)
Adjusted R-squared	0.03042	0.0009053

***p<0.001,**p<0.01,*p<0.05