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Re-thinking "the different perspectives that can be used when eliciting preferences in health"

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Re-thinking "the different perspectives that can be used when eliciting preferences in health"

Aki Tsuchiya (Sheffield) and Verity Watson (Aberdeen)

Abstract

The 2003 *Health Economics* paper by Dolan, Olsen, Menzel and Richardson on "An inquiry into the different perspectives that can be used when eliciting preferences in health" presents a conceptual framework of six perspectives along two dimensions: preferences (personal, social, and socially inclusive personal) and context (ex ante and ex post). The paper has been influential in setting the scene for empirical work which aims to elicit a social preference. The objective of our paper is to re-think this framework. Building on examples using monetary and non-monetary valuations (i.e health state valuation), we ask a few key questions: who is the beneficiary of the health improvement (i.e. the user)? Who pays for it (i.e. the payer) ? Who decides and in what capacity (i.e. the assessor)? Is there a correlation between the probabilities for people to become ill? These questions refine the preference and context dimensions, and identify perspectives not classified by the original framework. We propose an extended framework with 20 possible perspectives and present 11 of these formally to clearly distinguish between them.

1. **Introduction**

The paper "An inquiry into the different perspectives that can be used when eliciting preferences in health" (Dolan et al, 2003 – hereafter, the "DOMR" paper taking the initials of the four authors) presents a conceptual framework of six perspectives along two dimensions: preferences (personal, social, and socially inclusive personal) and contexts (ex ante and ex post):

> "The framework has two dimensions. The first concerns whom the respondent is asked to think about. It could be that the question is concerned with: (i) the respondent herself, in which case she is being asked for her *personal* preferences; (ii) people other than the respondent, thus eliciting her *social* preferences, or (iii) both the respondent and other people, which involves the elicitation of her *socially inclusive personal* preferences. The second dimension concerns the relative point in time at which the preference is elicited and, as a result, the degree of certainty associated with the need for health care. It could be that there is uncertainty about whether or not health care will be needed in the future (referred to as the *ex ante* context) or it could be that it is known that health care is needed now (referred to as the *ex post* context)." (DOMR, p.546; emphases in original)

The paper has been influential in setting the scene for empirical work on social value judgements that compares across interventions for different patient groups, and typically aims to elicit a social preference (for example, Gyrd-Hansen, 2005; Pinto-Prades, Abellán-Perpiñan, 2005; Schwappach, 2005; Dolan, Tsuchiya, 2009 – also see Gaertner, Schokkaert, 2012). However, the framework is intended to apply to many different kinds of preference elicitation exercise, including monetary valuation of a statistical life, and health state valuation.

The objective of our paper is to critically reassess the framework, and to illustrate its imprecision and incompleteness. First, along the preference dimension the DOMR framework defines the move

from the personal to the social perspective in terms of who becomes ill and not who bears the cost of treating the illness or in what capacity the respondent assesses the alternatives (and the framework is therefore imprecise). The roles of the respondent as user, payer and assessor should be defined clearly in the preference elicitation task. Furthermore, the DOMR framework does not allow for non-use or proxy preferences (and is therefore incomplete). Second, along the context dimension, the DOMR framework operationalises the context (i.e. ex post and ex ante) with respect to the timing of events, and does not allow for no uncertainty in the ex ante context (and is therefore incomplete). Moreover, the framework introduces risk in the social preference scenario without reference to the independence of the probabilities, in other words how the risk to one person might or might not be related to the risk to another person (and is therefore imprecise).

Instead, this paper distinguishes five preferences (personal, non-use, proxy, social and socially inclusive personal) and four contexts (one of which is ex post and three ex ante). Of these 20 possible perspectives, the paper focuses on 11. We will first set the context to ex post, and examine the five preferences, using examples in monetary valuation (contingent valuation: CV) and non-monetary health state valuation (time trade off; TTO). Then we move on to examine the ex ante context, where we focus on only two personal and four social preferences using CV scenarios – but the points made also apply to the other preferences and to TTO. Throughout, stylised scenarios are used as examples to illustrate a given perspective. These are made up of the following components:

- Who is to have the illness
- When they are ill – and if not yet ill, the probability of becoming ill
- What the payment numeraire is: money or years of life
- Who is making the sacrifice

Across the 11 preferences, the paper introduces 22 stylised scenarios (and eight more in the appendix). These are not intended as templates for preference elicitation questions to be used in an actual survey but as illustrations to convey the differences between the different perspectives from which preferences can be elicited. The 22 scenarios are summarised in two tables: Table 1 presents 15 ex post CV and TTO scenarios and Table 2 presents seven ex ante CV scenarios.

2.   The ex post personal, social, and socially inclusive personal preferences

The first re-think concerns the preference dimension and focuses on the ex post context. The DOMR paper distinguishes the personal and the social preferences with reference to two kinds of probability: p_p, which is the probability of one's own, personal, need for treatment; and p_o, which is

the probability that others in society will need treatment. DOMR sets out that an ex post personal perspective requires $p_p = 1$ and $p_o = 0$, while an ex post social perspective requires $p_p = 0$ and $p_o = 1$.

2.1. The ex post personal perspective

The welfare effect of change in health can be measured using compensating surplus (Freeman, 1993). This builds on the concept of compensating variation, but does not involve changes in relative price and therefore is applicable to non-market goods like health. (Similarly, equivalent surplus corresponds to equivalent variation.) A CV study can elicit the change in income that cancels out the welfare effect of improved health from an ex post personal perspective – viz. compensating surplus. Here is the example to illustrate the essence of this perspective:

(1) "Imagine you and only you currently have condition *X*: what is the maximum amount of money that you are willing to pay for a complete cure and be no worse off than in the current situation?" [ex post personal CV: user = you; payer = you; assessor = you]

The objective of the CV scenario is to identify the level of Δy_i that, given Δh_i and holding everything else constant, equalises the utility of two prospects so that:

$$u_i^i(y_i, h_i^X) = u_i^i(y_i - \Delta y_i, h_i^X + \Delta h_i),$$

where u_i represents the utility function of individual i; the superscript i indicates that it is as assessed by i; y_i represents income of individual i; h_i^X represents health of individual i in condition X; $h_i^X + \Delta h_i$ is assumed to represent recovery to full health; and assumes utility is an increasing function of income and of health.

From scenario (1) we can distinguish three roles that a respondent needs to take on to answer such personal preference scenarios in a rational manner: (a) the person who benefits from the treatment (the "user") indicated by the subscript to h; (b) the person who pays for the treatment (the "payer") indicated by the subscript to y; and (c) the person who arbitrates and decides, whose preference the scenario elicits (the "assessor") indicated by the superscript to u. In scenario (1), all three roles are assigned to "you", the respondent, represented by i. In any scenario, the assessor is always assigned to the respondent, while the user and payer roles need not be.

An ex post personal TTO scenario that corresponds to (1) can be represented as:

(2) "Imagine you and only you currently have condition *X*: what is the maximum number of years of life in full health that you are willing to give up for a complete cure and be no worse off than in the current situation?" [ex post personal TTO: user = you; payer = you; assessor = you]

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Health state valuations typically use "health state *X*" and specify a duration separately. However, we use "condition *X*" of no specified duration for comparability with CV, and for two pragmatic considerations: if health state *X* is specified for for 10 years, then the alternative cannot be a "complete cure" (a complete cure should not only achieve full health but also full life expectancy given current age); we do not specify duration at any level because later example scenarios become contrived (e.g. when user ≠ payer).

Using the same formula above, this time, y represents years of life; and h represents health related quality of life. (Actual implementation of a TTO elicitation task will require the specification of a multiplicative utility function between duration and health related quality of life.) The objective of the TTO scenario is to identify the size of Δy_i that equalises the utility of two prospects captured by the formula, given Δh_i and holding everything else (including income) constant.

As in (1), the user, payer and assessor roles are all assigned to the respondent. In practice, it is likely that p_o is left unspecified, so that while "you" currently have *X*, the respondent is not told if they are the only person with *X*. Indeed, provided it is clear that "you" as the payer are only paying for a cure for "you" as the user, then $p_o = 0$ is not necessary to elicit a personal preference using CV or TTO.

The wording of scenarios (1) and (2) does not exactly match the formula. The formula neutrally equates two outcomes, one with relatively high y and low h, and another with relatively low y and high h, without indicating how these outcomes occur. The verbal scenarios, on the other hand, indicate that "you" are invited to give up something of value ($-\Delta y_i$) *in exchange for* a complete cure ($+\Delta h_i$). In order to make the hypothetical scenarios mimic an actual market transaction, CV studies tend to favour such "exchange-based" wording. Arguably exchange-based wording, especially in health state valuation studies, may be susceptible to bias because it may invoke loss aversion or regret minimisation. With this caveat, we will continue to use exchange-based wording in our stylised scenarios, because it better facilitates the distinction between the user, the payer and the assessor roles than more neutral wording.

The DOMR framework indicates that social preferences are elicited by changing the probabilities to $p_p = 0$ and $p_o = 1$, so that the respondent is no longer the user. However, this is not sufficient to achieve a social perspective. For example:

(3) "Imagine a group of *n* people (not including you) who currently have condition *X* (which you will never get): what is the maximum amount of money that you are willing to pay for a complete cure for those who have *X* and be no worse off than in the current situation?"
[ex post personal non-use CV: user ≠ you; payer = you; assessor = you]

$$u_i^i(y_i, h_j^X) = u_i^i(y_i - \Delta y_i, h_j^X + \Delta h_j), \; i \neq j$$

This somebody else (j) may be one person, or more. Everything else (such as i's health or j's income) are assumed to stay constant. In (3) the user role has been separated from the respondent (subscript j for h), while the payer and assessor roles remain with the respondent (subscript i for y, and superscript i for u). Although this elicits a preference about outcomes for others (and hence is not personal), the *preference* itself is personal. Scenario (3) has similarities with the elicitation of "non-use values". Non-use values concern goods, for example, in a remote location that the respondent does not benefit from the use of directly. The valuation of non-use values separates the user and assessor roles; but not the payer and assessor roles. When the objective of the exercise is to estimate a non-use value in the form of individual compensating (or equivalent) surplus, then it is necessary that the payer role remains with the assessor role as in scenario (3). If the objective is an individual compensating surplus, then this is still a personal preference, not social preference, even if $p_p = 0$ and $p_o = 1$.

While typical examples of non-use value are found in environmental economics (e.g. the value of saving habitat in the arctic for polar bears), it is also possible to find examples in health. The term non-use value is hardly used in health economics, but such a scenario would elicit caring externalities. For instance, a woman may be asked for her willingness to pay towards treatment of prostate cancer, or a person living in the developed world may be asked for his willingness to pay towards treatment of diseases that are only prevalent in the developing world. The key point is that it is possible to specify $p_p = 0$ and $p_o = 1$ to elicit a personal non-use value. This is a perspective not included in the DOMR framework.

A TTO equivalent to (3) would look like this:

(4) "Imagine a group of n people (not including you) who currently have condition X (which you will never get): what is the maximum number of years of life in full health that *you* are willing to give up for a complete cure and be no worse off than in the current situation?" [ex post personal non-use TTO: user $\neq$ you; payer = you; assessor = you; same formula as scenario (3)]

This may appear extraordinary or even contrivied, because the nature of the payment numeraire (years of own life) requires the respondent's life to be shortened in exchange for a complete cure for a stranger. However, people sacrifice their own health in order to improve the health of others (e.g. live organ donors) - so the difficulty may be in the certainty of the TTO scenario rather than the numeraire (a Standard Gamble may feel less extraordinary).

Scenario (3) suggests that a social preference requires further separation of the payer role from the assessor role. But even that is not sufficient. The below scenarios separate the payer and assessor roles but keep the user and payer roles together:

(5) "Imagine a group of n people (not including you) who currently have condition X (which you will never get): what is the maximum amount of money that you think they are willing to pay for a complete cure for themselves and be no worse off than in the current situation?" [ex post personal proxy CV: user ≠ you; user = payer ≠you; assessor = you]

$$u_j^i(y_j,h_j^X) = u_j^i(y_j\text{-}\Delta y_j,h_j\text{+}\Delta h_j)$$

(6) "Imagine a group of n people (not including you) who currently have condition X: what is the maximum number of years of life in full health that you think they are willing to give up for a complete cure for themselves and be no worse off than in the current situation?" [ex post personal proxy TTO: user ≠ you; user = payer ≠ you; assessor = you; same formula as scenario (5)]

Here, the respondent as assessor is asked for their view (superscript i for u) on a factual matter: the other person's own personal preference or wellbeing (u_j). It is another perspective with p_p = 0 and p_o = 1 that is not included in the DOMR framework: this might be called proxy judgements, and it falls short of social preferences. The example illustrates that to build a social preference, the user and payer roles need to be separated from the assessor and each other.

2.2. The ex post social perspective

A scenario for an ex post social perspective might look like this:

(7) "Imagine a group of n people (not including you) who currently have condition X: what do you think is the maximum amount of money that *society* can pay for their complete cure and be no worse off than in the current situation?" [ex post social CV: user ≠ you; payer ≠ you; user ⊂ payer; assessor = you as decision maker]

As in (3) to (6) the user is somebody else (n ≥ 1), and separated from the assessor. While the scenario asks the respondent to assess ("what do you think"), the party who is assessed to be no worse off is not the respondent in person (so it is not a personal preference) but society (of N individuals), who is the (immediate) payer. Since society is made up of (and funded by) individuals, the users are likely to be a subset of the payers. Scenarios like this are typically motivated by asking the respondent to imagine themselves as an officer authorised to make such decisions on behalf of

the population: in other words, the scenario represents a social welfare function rather than an individual utility function. Such choices concern normative views on how society *should* operate – social value judgments – and can involve interpersonal comparisons and/or evaluation of fairness. Such judgements require a detached impartial perspective, which translates to the separation of the assessor role from the user and payer roles. Thus, the objective of the social CV scenario is to identify the size of the aggregate willingness to pay, $\Sigma_N \Delta y_j$, that equalises the social welfare of two prospects:

$$W^I[u_1(y_1, h_1^X), \ldots, u_n(y_n, h_n^X), u_{n+1}(y_{n+1}, h_{n+1}^F), \ldots, u_N(y_N, h_N^F)] = W^I[u_1(y_1 - \Delta y_1, h_1^X + \Delta h_1), \ldots, u_n(y_n - \Delta y_n, h_n^X + \Delta h_n), u_{n+1}(y_{n+1} - \Delta y_{n+1}, h_{n+1}^F), \ldots, u_N(y_N - \Delta y_N, h_N^F)],$$

$$\text{where } j = 1, \ldots, N; \ I \neq j; \ \partial W^I/\partial u_j > 0; \text{ and } \partial^2 W^I/\partial u_j^2 \leq 0.$$

W^I represents social welfare, as assessed by an impartial decision maker I, and defined as a function of the utility of individuals. The assessor, or superscript, of individual utility is deliberately left open. Welfarism defines social welfare as a function of individual utility as assessed by the individual themselves, u_j^j; while non-welfarism uses individual utility, or welfare, as assessed by the decision maker, u_j^I. The scenario is akin to a transfer from the healthy to the ill within society in a social welfare programme (where the ill themselves may also contribute). Note that the above (even the welfarist version) is not an aggregation of individual valuations of condition *X* captured by (1), and does not assume that $u_j(y_j, h_j^X) = u_j(y_j - \Delta y_j, h_j^F)$ holds for each *j*. It does not assume that individuals pay the same amount, either. Because of these, it may be difficult for a respondent to conceptualise aggregate willingness to pay ($\Sigma_N \Delta y_j$) as a measure of treating *n* cases of *X*.

A TTO scenario may look like this:

(8) "Imagine a group of *n* people (not including you) who currently have condition *X*: what do you think is the maximum number of years of life in full health that *society as a whole* are willing to give up for a complete cure for this group and be no worse off than in the current situation?" [ex post social TTO: user ≠ you; payer ≠ you; user ⊂ payer; assessor = you as decision maker; same formula as scenario (7)]

The difficulty of conceptualising $\Sigma_N \Delta y_j$ may be even greater for TTO, since the idea of a total number of years of life given up by society as a whole is unique, and may be confusing especially if the number of people in the payer group (*N*) is much larger than the number of people in the user group (*n*): e.g. suppose *N* = 50 million and *n* = 100; it may not be immediately obvious that, for example 1 minute multiplied by 50 million people amounts to 10 months multiplied by 100 people. An alternative approach to scenarios (7) and (8) might be to exclude the users from the pool of

payers, and to match the number of people in the user group and the payer group (*m*). Thus, for CV:

(9) "Imagine a group of *n* people (not including you) who currently have condition *X*: what do you think is the maximum amount of money that another group with the *same number of people* (*m = n*) in full health can give up for a complete cure for the first group and society to be no worse off than in the current situation?" [ex post subgroup social CV: user ≠ you; payer ≠ you; user ≠ payer; assessor = you as decision maker]

And, for TTO:

(10) "Imagine a group of *n* people (not including you) who currently have condition *X*: what do you think is the maximum number of years of life in full health that another group with the *same number of people* (*m = n*) can give up for a complete cure for the first group and society to be no worse off than in the current situation?" [ex post subgroup social TTO: user ≠ you; payer ≠ you; user ≠ payer; assessor = you as decision maker]

The objective here is to identify the size of $\Sigma_N \Delta y_j$ that equalises the social welfare of two prospects (*N > n + m*):

$$W^I[u_1(y_1,h_1^X), \ldots, u_n(y_n,h_n^X), u_{n+1}(y_{n+1},h_{n+1}^F), \ldots, u_N(y_N,h_N^F)] = W^I[u_1(y_1,h_1^X+\Delta h_1), \ldots,$$
$$u_n(y_n,h_n^X+\Delta h_n), u_{n+1}(y_{n+1}-\Delta y_{n+1},h_{n+1}^F), \ldots, u_{n+m}(y_{n+m}-\Delta y_{n+m},h_{n+m}^F), u_{n+m+1}(y_{n+m+1},h_{n+m+1}^F), \ldots,$$
$$u_N(y_N,h_N^F)]$$

As with scenario (7), the assessment by the respondents concerns W^I: i.e. whether *society* is no worse off.

2.3 Person trade off and budget pie applications

If the numeraire of scenario (10) is changed to the number of lives this will result in a variant of the person trade-off scenario (PTO; Patrick et al, 1973; Murray, Lopez, 1997):

(11) "Imagine a group of *n* people (not including you) who currently have condition *X*: what do you think is the maximum number of lives in full health (*m*) that another group of people can give up for a complete cure for the first group and society to be no worse off than in the current situation?" [ex post subgroup social PTO: user ≠ you; payer ≠ you; user ≠ payer; assessor = you as decision maker; same formula as scenarios (9) and (10)]

The objective of the PTO scenario is to identify the size of the second group (*m ≤ n*) that equalises the social welfare of two prospects in the formula immediately above, but where $y_j-\Delta y_j$ now

indicates being dead (notwithstanding h_j^{F}). Some variants of the PTO do not compare condition X against full health, but against another condition (Nord, 1992). This would generate the *relative* value of one condition against another. An actual PTO will contrast treating one group versus the other and a PTO scenario that builds on the framing of the preceding scenarios (in terms of compensating surplus) might look like this:

(12) "Imagine a group of *n* people who currently have condition X_n: what do you think is the maximum size (*m*) that another group of people who acquire condition X_m can be if the first group is completely cured and society is no worse off than in the current situation?" [ex post subgroup social relative PTO: user ≠ you; payer ≠ you; user ≠ payer; assessor = you as decision maker]

The respondent is in neither group. The objective here is to find the number *m* that would equalise the social welfare of two prospects, given *n* and where $N \geq n + m$:

$$W^{I}[u_1(h_1^{Xn}), \ldots, u_n(h_n^{Xn}), u_{n+1}(h_{n+1}^{F}), \ldots, u_N(h_N^{F})] = W^{I}[u_1(h_1^{Xn}+\Delta h_1^{n}), \ldots, u_n(h_n^{Xn}+\Delta h_n^{n}),$$
$$u_{n+1}(h_{n+1}^{F}-\Delta h_{n+1}^{m}), \ldots, u_{n+m}(h_{n+m}^{F}-\Delta h_{n+m}^{m}), u_{n+m+1}(h_{n+m+1}^{F}), \ldots, u_N(h_N^{F})]$$

Here, $h_j^{Xn}+\Delta h_j^{n}$ equals h_j^{F}, and y_j is assumed to be constant throughout and therefore dropped. Note that these examples of PTO elicit compensating surplus, where the tasks equate a health state improvement for group *n* with a reduction in health state or life years for group *m*. These are different from typical PTO tasks in the literature that elicit equivalent surplus, by equating health state improvements for one group with health state improvements for another group of a different size with a different health condition, instead.

In relative PTO tasks, the two groups can differ in terms of non-health characteristics (e.g. social class) alongside, or instead of, health. Furthermore, when cost per person is assumed to be the same across the two groups, the scenario becomes very similar to a "budget pie" task that asks respondents to allocate a finite health care budget across competing treatments, to elicit their relative values. An actual budget pie scenario will be framed in terms of the proportion of resources allocated to one treatment over the other, and thus of the number of people to be treated from each group (*n* + *m* = constant). But a (somewhat contrived) budget allocation scenario that is framed to match the PTO formula above might look like this:

(13) "Imagine there are two groups of people of equal size who currently have conditions X_n and X_m respectively, which cost the same per patient to treat, and not enough resources to treat everybody: what do you think is the combination of the number of people from each group to treat that would make treating either group equally good for society?" [ex post

subgroup social budget pie: user ≠ you; payer ≠ you; user ≠ payer; assessor = you as decision maker; same formula as scenario (12); *n* + *m* = constant]

If a respondent perceives the budget pie task as one where a choice is made between two competing health improvements to one group versus another group, then this would elicit an equivalent surplus. If the respondent, instead, perceives the task as one where a reduction in health improvement for one group is compensated by an increase in health improvement to the other group, then the task will elicit a compensating surplus.

The last two scenarios (12) and (13) illustrate that in a social scenario, when the user and the payer are separate, the trade-off need not be across two different goods (viz. money vs health; or survival vs health related quality of life) and can be across the same good (health) of different people, which allows the comparison between the social value of a unit of health to one group relative to another.

2.4. The ex post socially inclusive personal perspective

The DOMR paper states that in a socially inclusive personal perspective, "an individual is asked to consider her own self-interest as well as the interests of others" (p.546). The example in Menzel (1999) explicitly instructs the respondent to consider "both your own self-interest and what you think is best collectively" (p.264). Here is an ex post scenario that adapts scenario (7):

(14) "Imagine *a group of n people including you* currently have condition *X*: what do you think is the maximum amount of money that *society* can pay for a complete cure and be no worse off than in the current situation?" [ex post socially inclusive personal CV: users ∋ you; payers ⊃ users; assessor = you as an individual and as a decision maker]

Under the socially inclusive personal perspective, the assessor is one of the users, and the users are a subset of the payers as in (7). The DOMR framework assumes that responses to the fully personal (1) and fully social (7) will differ and the response to (14) will lie between these two. Menzel (1999) makes a contractarian case for socially inclusive personal preferences:

"consent to particular policies – and willingness to be bound by them – is unquestionably an important positive step in the achievement of a sense of fairness in making decisions with enormous negative repercussions for selected individuals. In an area of life where the stakes for an individual or family can be as high as they are in health care, and where moral struggle can be wrenching, consent can provide badly needed credence for any policies that emerge from it." (pp.264-265)

The implication is that responses to scenario (1) representing u_i^i can be too self-centred while responses to scenario (7) representing W^I can be too uncommitted, and therefore scenario (14) has

the best hope of striking the right balance. So, it may be possible to represent scenario (14) by introducing a relative weight (α) to capture this balance between scenarios (1) and (7): $\alpha W^I[u_N] + (1-\alpha)u_i^i$. But within a range from $\alpha = 0$ (identical to u_i^i) to $\alpha = 1$ (identical to W^I), there is no guidance on what value this relative weight should take. A serious problem with this approach is that unless responses to (1) and (7) are also elicited from the same respondents, there will be no way of gauging the relative weight (α) that each respondent gives self-interest and interests of others in (14).

A non-monetary valuation scenario using TTO from a socially inclusive personal perspective might be built from (14) and(8), and look like this:

(15) "Imagine *a group of n people including you* currently have condition *X*: what do you think is the maximum number of years of life in full health that *society as a whole* can give up for a complete cure for your group and be no worse off than in the current situation?" [ex post socially inclusive personal TTO: users $\ni$ you; payers $\supset$ users; assessor = you as an individual and as a decision maker]

The points made for (14) apply to (15).

Note that subgroup scenarios such as (9) to (13) are not possible in an ex post socially inclusive personal perspective, because in order for the assessor to be able to contrast the benefits to the user and the costs to the payer without bias, she needs to be a member of both the user group and the payer group, while scenarios (9) to (13) do not allow this as they separate out the user group from the payer group.

3.   The ex ante personal and social preferences

Let us now move on to the context dimension and examine the ex ante context under personal, and social preferences. For simplicity, all the scenarios in this section are for CV tasks. The seven ex ante scenarios discussed in this section are summarised in Table 2. (For non-use and proxy CV scenarios and TTO scenarios, see the Appendices.) When a future prospect needs to be assessed, this can be done either before the event on the basis of expected outcomes (ex ante), or after the event with respect to the realised outcomes (ex post).

In the below we distinguish four "cases", where each is illustrated using an example involving *N* individuals (none of whom are currently ill), and expected patient numbers of $n = pN.$ DOMR distinguishes the ex ante and the ex post with reference to "the relative point in time at which the preference is elicited" (p.546) and imposes uncertainty. We extend the framework by adding case 1, an ex ante context with no uncertainty. DOMR also introduces risk of illness in a population without

reference to the independence of probability of illness across members of the population. Cases 2-4 below illustrate three possible probability correlations.

Case 1: n known individuals will become ill and the rest will remain healthy; this might be thought of as a set of n cards each with an individual's name on it – there will be n patients for certain who are known beforehand but not yet ill;

Case 2: randomly selected n people from N will become ill and the rest will remain healthy; here, there is an envelope containing N cards, where n of them are marked for illness, and each of the N individuals takes a draw, with *no* replacement (i.e. a card that is drawn is not put back in the envelope) – ex post there will be exactly n patients, although it is not known ex ante which individuals it will be;

Case 3: each of the N individuals have an independent probably p of becoming ill or otherwise remaining healthy; this time individuals take a draw from the above envelope, *with* replacement (i.e. a card that is drawn is put back in the envelope) – ex ante the expected number of patients is n, while the number ex post will follow a binomial distribution $B(N,p)$ with mean of n;

Case 4: with probability p all individuals will become ill; otherwise all individuals will remain healthy; just one draw is taken from the same envelope for the whole group – ex ante the expected number of patients is n, while ex post it will be either zero or N, and never actually n.

Case 1 involves no uncertainty. Cases 2 and 4 are examples with fully correlated probabilities of becoming ill (with negative and positive correlations). Of course, there can be further, intermediate cases. Case 3 is an example where the probabilities of becoming ill are entirely independent. In all cases the ex ante expected outcome is n patients, while the ex post outcome ranges from: n (cases 1 and 2); a distribution with mean n (case 3); and zero or N (case 4). Examples corresponding to the first and third cases were discussed by Diamond (1967) and re-visited by Broome (1982): expected utility theory cannot distinguish between cases 2, 3, or 4.

3.1. The ex ante personal perspective

Let us apply the four cases to the personal perspective, involving just one individual. Assuming individuals are selfish and are not affected by the health of others, a personal version of these four cases, from individual i's perspective, reduces to:

Case Ia: individual i will not become ill – as far as i alone is concerned, there will be no illness;

> **Case Ib**: individual i will become ill – as far as i alone is concerned, there will be one patient (i) for certain;
>
> **Case II**: with probability p individual i becomes ill; otherwise i remains healthy – the expected number of patients is p, although ex post it will either be one or zero, and never actually p.

Case Ia is not of interest (the individual will not become ill so the willingness to pay will be zero). The distinctions between cases 2, 3, and 4 are not meaningful in a single-person scenario, since in all cases the individual faces a probability of illness of p.

In case 1 (Ib) there is no uncertainty – so this would not be ex ante in the conventional sense. However, the DOMR paper distinguishes ex-ante and ex post contexts with respect to the timing of events. To follow this, it is possible to set CV (and TTO) scenarios before the event, with no uncertainty. A scenario for case Ib might look like this:

> (16) "Imagine you are about to develop condition *X with certainty*: what is the maximum amount of money that you can pay *now* to *ensure a complete cure* in the future when you become ill and be no worse off than the current situation (not paying and facing the condition)?" [ex ante case I personal CV: user = you; payer = you; assessor = you]
>
> $$u_i^i(y_i,h_i^F-\Delta h_i) = u_i^i(y_i-\Delta y_i,h_i^F-\Delta h_i+\Delta h_i)$$

For simplicity, we ignore time preference. For an ex ante scenario to be meaningfully distinct from the corresponding ex post scenario, it is necessary to assume that cure is available only if payment is made now.

Introducing uncertainty, a case II ex ante personal CV scenario might look like this:

> (17) "Imagine you will develop condition *X* with probability p: what is the maximum amount of money that you can pay now to *ensure a complete cure* in the future *if* you become ill and be no worse off than the current situation (not paying and facing the risk)?" [ex ante case II personal CV: user = you; payer = you; assessor = you]
>
> $$pu_i^i(y_i,h_i^F-\Delta h_i) + (1-p)u_i^i(y_i,h_i^F) = pu_i^i(y_i-\Delta y_i,h_i^F-\Delta h_i+\Delta h_i) + (1-p)u_i^i(y_i-\Delta y_i,h_i^F)$$

The answer, or the size of Δy_i, in (17) will depend on: the value of Δh_i; risk aversion or the shape of the utility function (u_i); and the subjective interpretation of probability p. In other words, by contrasting (17) with (16), the effect of people's aversion to risk and perception of probabilities can be examined. But if the objective is to value Δh_i alone, then an ex ante preference would be confounded.

Scenarios that describe developing the condition and having it cured are cumbersome, and it is not obvious that respondents will assume $u_i^i(y_i,h_i^F-\Delta h_i+\Delta h_i) = u_i^i(y_i,h_i^F)$. Therefore, although the

DOMR paper only uses curative examples, it is more realistic to use a preventative intervention to operationalise the ex ante context with uncertainty:

(18) "Imagine you will develop condition X *with probability p*: what is the maximum amount of money that you can pay now for *a complete prevention* and be no worse off than the current situation (not paying and facing the condition)?" [ex ante case II prevention personal CV: user = you; payer = you; assessor = you]

$$pu_i^i(y_i,h_i^F\text{-}\Delta h_i) + (1\text{-}p)u_i^i(y_i,h_i^F) = u_i^i(y_i\text{-}\Delta y_i,h_i^F)$$

However, preventative and curative scenarios have different welfare economic interpretations. The objective of the preventative scenario (18) is to identify the size of the payment ($-\Delta y_i$) that equalises the utility of two future prospects shown, given the size of the potential health loss ($-\Delta h_i$) and keeping everything else constant. In this scenario, the user is not yet ill and the willingness to pay task elicits an equivalent surplus of avoiding the health loss ($-\Delta h_i$), a bad, which makes two mutually exclusive outcomes equivalent: to keep the money and experience the illness; *or* to pay for the prevention and not experience the illness. This is in contrast to curative scenarios, where the user is or will become ill and the willingness to pay task elicits a compensating surplus for the health gain (Δh_i), a good, which makes the value of two things cancel out: the benefit of the cure *and* the cost of paying for it. Welfare economic theory predicts that the compensating surplus (variation) of a good and the equivalent surplus (variation) of a bad will agree[1].

3.2. The ex ante social perspective

Similarly to the personal perspective, it is possible to build CV (or TTO) scenarios set before the event but involving no uncertainty. These would represent case 1. Following the DOMR paper, let us go back to curative scenarios. An ex ante social CV scenario with no uncertainty can build on the ex post social CV (7), and might look like this:

(19) "Imagine a group of *n* already identified people will develop condition *X* with certainty: what do you think is the maximum amount of money that *society* can pay now for a complete cure for this group in the future when they become ill and be no worse off than in the current situation?" [ex ante case 1 social]

---

[1] In both cases, respondents' willingness to pay (WTP) is elicited. Either the WTP for the good or the WTP to avoid the bad. This is different from the literature that compares WTP and willingness to accept compensation (WTA), which compares the compensating and equivalent variation of either the same good or the same bad. For instance, by comparing WTP for the good, and WTA for not receiving the good.

$$W^I[u_1(y_1,h_1^F\text{-}\Delta h_1), \ldots, u_n(y_n,h_n^F\text{-}\Delta h_n), u_{n+1}(y_{n+1},h_{n+1}^F), \ldots, u_N(y_N,h_N^F)] = W^I[u_1(y_1\text{-}\Delta y_1,h_1^F\text{-}$$
$$\Delta h_1+\Delta h_1), \ldots, u_n(y_n\text{-}\Delta y_n,h_n^F\text{-}\Delta h_n+\Delta h_n), u_{n+1}(y_{n+1}\text{-}\Delta y_{n+1},h_{n+1}^F), \ldots, u_N(y_N\text{-}\Delta y_N,h_N^F)]$$

Since the scenario concerns *n* known individuals, anonymity is violated. Thus, (contrary to convention) the subscripts *j* identify unique individuals.

Ex ante social perspective scenarios can be built in three different ways corresponding to cases 2, 3 and 4, all of which have *n = pN* expected patients. Under case 2, there will be *pN* (=*n*) patients with certainty, although it is not known beforehand who these will be. So while there is uncertainty at the individual level, there is no uncertainty at the social level.

(20) "Imagine a proportion *p* of *N* people will develop condition *X*: what is the maximum amount of money that society can pay now to ensure a complete cure for this group in the future if they become ill and be no worse off than the current situation (not paying and facing the risk)?" [ex ante case 2 social]

$$W^I[u_1(y_1,h_1^F\text{-}\Delta h_1), \ldots, u_n(y_n,h_n^F\text{-}\Delta h_n), u_{n+1}(y_{n+1},h_{n+1}^F), \ldots, u_N(y_N,h_N^F)] = W^I[u_1(y_1\text{-}\Delta y_1,h_1^F\text{-}$$
$$\Delta h_1+\Delta h_1), \ldots, u_n(y_n\text{-}\Delta y_n,h_n^F\text{-}\Delta h_n+\Delta h_n), u_{n+1}(y_{n+1}\text{-}\Delta y_{n+1},h_{n+1}^F), \ldots, u_N(y_N\text{-}\Delta y_N,h_N^F)]$$

Note that this formula is the same as the one for scenario (19), but while scenario (19) violates anonymity (because the identities of the individuals matter), scenario (20) does not (and therefore individual identity is ignored). Since anonymity means that the *j* subscripts in (20) do not represent specific individuals and at the social level individuals are interchangeable, scenario (20) has no uncertainty in terms of overall outcomes – there will be *n* ill peole for certain – and therefore this can be used to elicit aversion to inequality in outcomes, in the absence of risk at the societylevel.

Under case 3, the health outcome will follow a binomial distribution with a mean of *pN*.

(21) "Imagine *N* people are susceptible to develop condition *X* each with independent probability *p*: what is the maximum amount of money that society can pay now for a complete cure for this group in the future if they become ill and be no worse off than the current situation (not paying and facing the risk)?" [ex ante case 3 social]

$$W^I[\, pu_1(y_1,h_1^F\text{-}\Delta h_1) + (1\text{-}p)u_1(y_1,h_1^F), \ldots, pu_N(y_N,h_N^F\text{-}\Delta h_N) + (1\text{-}p)u_N(y_N,h_N^F)\,] = W^I[pu_1(y_1\text{-}$$
$$\Delta y_1,h_1^F\text{-}\Delta h_1+\Delta h_1) + (1\text{-}p)u_1(y_1\text{-}\Delta y_1,h_1^F), \ldots pu_N(y_N\text{-}\Delta y_N,h_N^F\text{-}\Delta h_N+\Delta h_N) + (1\text{-}p)u_N(y_N\text{-}$$
$$\Delta y_N,h_N^F)]$$

Here, expected social welfare is expressed as a function of expected utility of individuals. As with (7), this does not assume $pu_j(y_j,h_j^F\text{-}\Delta h_j) + (1\text{-}p)u_j(y_j,h_j^F) = pu_j(y_j\text{-}\Delta y_j,h_j^F\text{-}\Delta h_j+\Delta h_j) + (1\text{-}p)u_j(y_j\text{-}\Delta y_j,h_j^F)$ for each individual *j*, or that individuals pay the same amount. The response to such a scenario will depend on: the value of Δh_i; the shape of the social welfare function (W^I); and the respondent's subjective interpretation of probability *p*. The shape of the social welfare function

can represent risk aversion, inequality aversion, or both, but since both kinds of aversion result in diminishing marginal social welfare in individual utility, the two cannot be distinguished from each other using scenario (21).

Under case 4, the expected number of patients is *pN*, but ex post, there will be either zero or *N* patients, and never *pN* (= *n*).

> (22) "Imagine that with probability *p* everybody (*N*) will develop condition *X*; otherwise everybody will remain healthy: what is the maximum amount of money that everybody in this group can pay now for a complete cure for themselves in the future if they become ill and be no worse off than the current situation (not paying and facing the risk)?" [ex ante case 4 social]
>
> $pW^I[u_1(y_1,h_1^F-\Delta h_1), \ldots, u_N(y_N,h_N^F-\Delta h_N)] + (1-p)W^I[u_1(y_1,h_1^F), \ldots, u_N(y_N,h_N^F)] = pW^I[u_1(y_1-\Delta y_1,h_1^F-\Delta h_1+\Delta h_1), \ldots, u_N(y_N-\Delta y_N,h_N^F-\Delta h_N+\Delta h_N)] + (1-p)W^I[u_1(y_1-\Delta y_1,h_1^F), \ldots, u_N(y_N-\Delta y_N,h_N^F)]$

This scenario can be used to elicit social-level aversion to risk, in the absence of (ex post) inequality across individuals.

4. Summary and discussion

In this paper we critically reassessed the DOMR conceptual framework of the perspectives that can be used to elicit preferences in health. The DOMR framework has influenced empirical work on social value judgements, but a conceptual framework of perspectives is important for all preference elicitation research and not just for social value judgments. In this paper we show that the DOMR framework is imprecise and incomplete in both the preference dimension and context dimension. We present an expanded conceptual framework consisting of five preferences and four contexts, and illustrate 11 of these in detail. These are accompanied by 22 stylised scenarios to illustrate the key features of each.

In the preference dimension, the DOMR framework defines the difference between a personal and a social perspective based on who is or becomes ill. We show that individuals can take three roles in a preference elicitation task: the user (the person who is/becomes ill); the payer (the person who bears the cost alleviating the illness); and the assessor (the person who arbitrates and decides). We show that it is possible to elicit personal preferences when the user is not the payer or assessor, and the preferences elicited would measure caring externalities. We also present a scenario in which personal-proxy assessments could be elicited when the user and payer roles are separated from the assessor. Given this, we propose two more preferences to add to the three in

DOMR: the non-use and the proxy. We show that social preference should be defined with respect to who the assessor is (you as a private individual versus you as a decision maker), and not with respect to who the user is. At the extreme, at least in theory, it is possible to conceive of a social scenario where "you as a private individual" have condition X and "you as the decision maker" are to assess society's willingness to pay to treat the condition (while in practice, this would be susceptible to obvious bias).

In the context dimension, the DOMR framework differentiates between ex ante and ex post contexts using the future events that occur with probability p that is strictly less than 1. This does not allow for future events that occur with certainty, which we now include. Moreover, in the DOMR framework with social preferences the independence of probabilities between groups is not defined. We extend the framework to distinguish between three risky cases within the ex ante context: where individual outcomes are drawn with no replacement so that the ex post number of ill people is exactly n with no uncertainty (but with inequality across N); where individual draws are independent (dwawn with replacement) so that the ex post outcome follows a binomial distribution with mean of n where the outcome is uncertain and unequal; and where one outcome is drawn for the whole group so that the ex post outcome is uncertain (either 0 or N) but with no inequality. This extended framework thus highlights the perspectives that are necessary if the researcher wants to elicit inequality aversion (scenario (20)) or (social) risk aversion (scenario (22)). When an ex ante social elicitation task is not specific enough to indicate which case of uncertainty is intended, it is arguably most likely that respondents assume independent probabilities (case 3; scenario (21). This is where the two types of aversion are confounded, and in the DOMR framework it was not clear how these would affect ex ante social preferences.

The extended framework will facilitate comparisons across empirical studies with more clarity at the conceptual level, by classifying studies into one of 20 preferences. Equally, this can be used to guide the design of empirical studies. Our extended framework could help researchers to have the most appropriate framework for their research question. The framework provides a set of roles the respondent can be asked to take and clarifies the role of risk in an ex-ante context. It should also be noted that the framework does not cover all the practical features of an actual scenario. For example, it does not refer to payment vehicles (e.g. out of pocket or insurance premium in CV; or TTO or SG in heatlh state valuation), or routing and ordering (double bounded dichotomous choice or bidding game in CV; ping pong or titration in TTO), framing effects or other sources of bias. These other issues have alreadyreceived extensive attention in health economics, in particular in the CV literature (Smith, 2003; Hackl and Pruckner, 2005; McNamee, 2010; Luchini and Watson, 2013; Ternent and Tsuchiya, 2013).

O'Brien and Gafni (1996) present a conceptual framework for contingent valuation studies and focus on the five considerations for contingent valuation studies to ensure that the elicitation task is consistent with cost benefit analysis (CBA). Several of the considerations they identify are reflected in our extended framework. O'Brien and Gafni (1996) and Gafni (1991) question whether ex-post elicitation of service user's personal preference is appropriate when CBA of a collectively funded health care service should take account of all benefits to society. O'Brien and Gafni (1996) identify both non-use values and option values as preferences that are omitted if only ex-post user personal preferences are elicited. Our extended framework includes non-use preferences in our extended set of preference dimensions. Further, our extended ex-ante context dimension allows for option values and our treatment of risk includes the uncertain outcomes identified by O'Brien and Gafni (1996).

Recent years have seen increased interest in applying the evaluation methods used for health care to public health interventions (Edwards et al, 2013). Public health programmes aim to have a range of outcomes that need to be valued when the programme is evaluated. Within these are several that require elicitation perspectives not covered by DOMR. Public health programmes have spill-over effects on on individuals not targeted by the programme and therefore require the elicitation of non-use preferences. Many public health interventions include equity considerations and require elicitation of inequality aversion in outcomes. Public health programmes are often preventative rather than curative. Our extended framework has better coverage to accommodate these applications.

Table 1: Summary of ex post preference scenarios

preference	user	payer	trade[b]	CV[c]	TTO	PTO	BP	
Personal	you	you	across different goods	(1)	(2)			$u_i^i(y_i,h_i^X) = u_i^i(y_i-\Delta y_i, h_i^X+\Delta h_i)$
Non-use	≠ you	you		(3)	(4)			$u_i^i(y_i,h_j^X) = u_i^i(y_i-\Delta y_i, h_j^X+\Delta h_j), i \neq j$
Proxy	≠ you	user		(5)	(6)			$u_j^i(y_j,h_j^X) = u_j^i(y_j-\Delta y_j, h_j^X+\Delta h_j)$
Social	∌ you	society		(7)	(8)			$W^I[u_{1\ldots n}(y_j,h_j^X); u_{n+1\ldots N}(y_j,h_j^F)] = W^I[u_{1\ldots n}(y_j-\Delta y_j,h_j^X+\Delta h_j); u_{n+1\ldots N}(y_j-\Delta y_j,h_j^F)]$ [d]
		subgroup		(9)	(10)	(11)		$W^I[u_{1\ldots n}(y_j,h_j^X); u_{n+1\ldots N}(y_j,h_j^F)]$ $= W^I[u_{1\ldots n}(y_j,h_j^X+\Delta h_j); u_{n+1\ldots n+m}(y_j-\Delta y_j,h_j^F); u_{n+m+1\ldots N}(y_j,h_j^F)]$
		same				(12)	(13)	$W^I[u_{1\ldots n}(h_j^{Xn}); u_{n+1\ldots N}(h_j^F)] = W^I[u_{1\ldots n}(h_j^F); u_{n+1\ldots n+m}(h_j^{Xm}); u_{n+m+1\ldots N}(h_j^F)]$ [e]
SIP[a]	∋ you	society	different	(14)	(15)			$\alpha W^I[u_{1\ldots N}]+ (1-\alpha)u_i^i$

a) SIP: Socially inclusive personal;
b) Trade: "across different goods" money and health (CV) or survival and HRQOL (TTO); "same" trading same good (across different people)
c) CV: Contingent valuation; TTO: Time trade off; PTO: Person trade off; BP: Budget pie
d) $W^I[u_{1\ldots n}(y_j,h_j^X); u_{n+1\ldots N}(y_j,h_j^F)]$ is a shorthand for $W^I[u_1(y_1,h_1^X), \ldots, u_n(y_n,h_n^X), u_{n+1}(y_{n+1},h_{n+1}^F), \ldots, u_N(y_N,h_N^F)]$
e) $m + n =$ constant, for (13)

Table 2: Summary of ex ante CV scenarios[a]

preference	user	payer	cur/pre[b]	Ex post n	case	CV	
Personal	you	you	cur	1	I	(16)	$u_i^i(y_i,h_i^F-\Delta h_i) = u_i^i(y_i-\Delta y_i,h_i^F-\Delta h_i+\Delta h_i)$
				0 or 1	II	(17)	$pu_i^i(y_i,h_i^F-\Delta h_i) + (1-p)u_i^i(y_i,h_i^F) = pu_i^i(y_i-\Delta y_i,h_i^F-\Delta h_i+\Delta h_i) + (1-p)u_i^i(y_i-\Delta y_i,h_i^F)$
			pre			(18)	$pu_i^i(y_i,h_i^F-\Delta h_i) + (1-p)u_i^i(y_i,h_i^F) = u_i^i(y_i-\Delta y_i,h_i^F)$
Social	≠ you	society	cur	n	1	(19)	$W^I[u_{1\ldots n}(y_j,h_j^F-\Delta h_j); u_{n+1\ldots N}(y_j,h_j^F)] = W^I[u_{1\ldots n}(y_j-\Delta y_j, h_j^F-\Delta h_j+\Delta h_j) + u_{n+1\ldots N}(y_j-\Delta y_j,h_j^F)]$ [c]
				$pN = n$	2	(20)	$W^I[u_{1\ldots n}(y_j,h_j^F-\Delta h_j); u_{n+1\ldots N}(y_j,h_j^F)] = W^I[u_{1\ldots n}(y_j-\Delta y_j, h_j^F-\Delta h_j+\Delta h_j) + u_{n+1\ldots N}(y_j-\Delta y_j,h_j^F)]$ [d]
				$B(N,p) = n$ [e]	3	(21)	$W^I[pu_1(y_1,h_1^F-\Delta h_1) + (1-p)u_1(y_1,h_1^F), \ldots, pu_N(y_N,h_N^F-\Delta h_N) + (1-p)u_N(y_N,h_N^F)]$ $= W^I[u_{1\ldots n}(y_j-\Delta y_j, h_j^F-\Delta h_j+\Delta h_j) + u_{n+1\ldots N}(y_j-\Delta y_j,h_j^F)]$ (4)
				0 or N	4	(22)	$pW^I[u_{1\ldots N}(y_j,h_j^F-\Delta h_j)] + (1-p)W^I[u_{1\ldots N}(y_j,h_j^F)]$ $= pW^I[u_{1\ldots N}(y_j-\Delta y_j, h_j^F-\Delta h_j+\Delta h_j)] + (1-p)W^I[u_{1\ldots N}(y_j-\Delta y_j,h_j^F)]$

a) See appendices for ex ante personal TTO, social TTO, and SIP CV
b) cur/pre: curative or preventative; N: the population; n: actual number of patients = pN
c) non-anonymous: the j subscripts identify unique individuals
d) anonymous: the j subscripts represent interchangeable individuals
e) $B(N,p)$: binomial distribution with N trials and probability p, with mean of n

References

Broome, J. (1982). Equity in risk bearing. *Operations Research* 30(2), 412-414.

Diamond, PA. (1967). Cardinal welfare, individualistic ethics and interpersonal comparisons of utility, comment. *Journal of Political Economy* 75,765-766.

Dolan, P., Olsen, JA., Menzel, P., Richardson, J. (2003). An inquiry into the different perspectives that can be used when eliciting preferences in health, *Health Economics*, 12: 545-551.

Dolan, P., & Tsuchiya, A. (2009). The social welfare function and individual responsibility: some theoretical issues and empirical evidence. *Journal of Health Economics*, 28(1), 210-220.

Edwards, RT., Charles, JM., Lloyd-Williams, H. (2013). Public health economics: a systemtatic review of guidance for the economic evaluation of public health interventions and discussion of key methodological issues. *BMC Public Health*, 13, 1001.

Freeman, AM. (1993). The *Measurement of Environmental and Resource Values*, RFF Press.

Gaertner, W., & Schokkaert, E. (2012). *Empirical social choice: questionnaire-experimental studies on distributive justice*. Cambridge University Press.

Gyrd-Hansen, D. (2005). Willingness to pay for a QALY. *Pharmacoeconomics*, 23(5), 423-432.

Hackl, F., & Pruckner, GJ., (2005). Warm glow, free riding and vehicle neutrality in a health-related contingent valuation study. *Health Economics,* 14, 293-306.

Luchini, S., &Watson, V. (2013). Framing and certainty in a valuation task. *Journal of Economic Psychology,* 39, 204-214.

McNamee, P., Ternent, L., Gbangou, A., Newlands, D. (2010). A game of two halves? : Incentive incompatibility, starting point bias and the bidding game contingent valuation method. *Health Economics,* 19(1): 75-87.

Menzel, P. (1999). How should what economists call "social values" be measured?, *The Journal of Ethics*, 3: 249-273.

Murray, CJ., & Lopez, AD. (1997). Regional patterns of disability-free life expectancy and disability-adjusted life expectancy: Global Burden of Disease Study. *The Lancet*, 349(9062), 1347-1352.

Nord, E. (1992). Methods for quality adjustment of life years. *Social Science & Medicine*, 34(5), 559-569.

O'Brien, B., & Gafni, A. (1996). When do the "dollars" make sense? Toward a conceptual framework for contingent valuation studies in health care. *Medical Decision Making*, 16(3), 288-299.

Patrick, DL., Bush, JW., Chen, MM. (1973). Methods for measuring levels of well-being for a health status index. *Health Services Research*, 8(3), 228.

Pinto-Prades, JL., & Abellán-Perpiñán, JM. (2005). Measuring the health of populations: the veil of ignorance approach. Health Economics, 14(1), 69-82.

Schwappach, DL. (2005). Are preferences for equality a matter of perspective?. *Medical Decision Making*, 25(4), 449-459.

Smith R.D., (2003). Construction of the contingent valuation market in healthcare: a critical assessment. *Health Economics*, 12, 609-628.

Ternent L, Tsuchiya A (2013), A note on the expected biases in conventional iterative health state valuation protocols, *Medical Decision Making*, 33:544–546

Appendices

TTO scenario corresponding to (16):

"Imagine you are about to develop condition X with certainty: what is the maximum number of years of life in full health that you can commit now to give up to ensure a complete cure in the future when you become ill and be no worse off than the current situation (not giving up life years and facing the condition)?" [ex ante case I personal TTO: user = you; payer = you; assessor = you]

TTO scenario corresponding to (17)

"Imagine you will develop condition X with probability p: what is the maximum number of years in full health that you can commit now to give up to ensure a complete cure in the future, and be no worse off than the current situation (not giving up life years and facing the risk)?" [ex ante case II personal TTO: user = you; payer = you; assessor = you]

Ex ante non-use CV based on (3)

"Imagine a group of n people (not including you)will develop condition X with probability p (which you will never get): what is the maximum amount of money that you can pay for a complete cure in the future for those who will get X and be no worse off than in the current situation?" [ex ante non-use CV: user ≠ you; payer = you; assessor = you]

Ex ante proxy CV based on (5)

"Imagine a group of n people (not including you)will develop condition X with probability p (which you will never get): what is the maximum amount of money that you think they can pay for a complete cure in the future for themselves and be no worse off than in the current situation?" [ex ante proxy CV: user ≠ you; user = payer ≠ you; assessor = you]

TTO scenario corresponding to (19) based on (10)

"Imagine *a group of n* already identified people is about to develop condition X with certainty: what do you think is the maximum number of years of life in full health that another group with the *same number of people ($m = n$)* might give up for a complete cure in the future for the first group and society to be no worse off than in the current situation?" [ex ante case 1 subgroup social]

TTO scenario corresponding to (20) based on (10)

"Imagine proportion p of N people will develop condition X: what is the maximum number of years of life in full health that another group with the *same number of people ($m = n$)* might commit now to give up for a complete cure in the future and be no worse off than the current situation (not paying and facing the lottery)?" [ex ante case 3 subgroup social]

TTO scenario corresponding to (21) based on (10)

"Imagine *a group of n* people will develop condition X each with independent probability p: what is the maximum number of years of life in full health that another group with the *same number of people ($m = n$)* might commit now to give up for a complete cure in the future for the first group and society to be no worse off than the current situation (not paying and facing the risk)?" [ex ante case 2 subgroup social]

TTO scenario corresponding to (22)

"Imagine that with probability p everybody (N) will develop condition X; otherwise everybody will remain healthy: what is the maximum number of years of life in full health that everybody in this group might commit now to give up for a complete cure in the future and be no worse off than the current situation (not paying and facing the risk)?" [ex ante case 4 social]