Understanding Valuing Life Expectancy Gains from Air Pollution Reduction in the UK and Poland: A Qualitative Investigation and Validation

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Abstract

In this paper, we report the results of a qualitative study in the UK and Poland to assess the efficacy of a survey protocol used in a previous contingent valuations study designed to elicit a Value of a Life Year (VOLY) from air pollution reduction. The manner in which the improvement in life expectancy is delivered - from very small, ongoing reductions in the risk of death – is complex and unfamiliar to respondents. The protocol is therefore judged in terms of how well it helps respondents understand the cumulative nature of this gain over a lifetime and its uncertain nature, as opposed to envisaging it as an 'add-on; of life at the end. The analysis indicates that the protocol was successful in reducing the use of the 'add-on heuristic to a minority of respondents. Of those that understood the cumulative nature of the gain, only some verbalized an explicit understanding that this gain increased over life as opposed to a constant gain each year. Most respondents recognized that the gain was in some way uncertain. The most pervasive exogenous (to the gain in life expectancy) concern considered by some respondents was a perceived improvement in quality of life. Our overall judgement is that the protocol worked very well in both countries in some aspects, but further improvements could be made, in particular with respect to developing a more in-depth intuitive understanding of changes in underlying probabilities, the variable nature of the gain to individuals and more assistance in separating out wider concerns from their understanding of the good (at least for some respondents).

1. Introduction

Health interventions deliver benefits to individuals in many different ways. In this paper, we focus on the valuation of a particular benefit – that of gains in life expectancy. A gain in life expectancy can, in principle, be generated by any one of an infinite number of different perturbations in the probability density function for an individual's remaining length of life where the perturbations arise from small changes (improvements) in the conditional probabilities of survival over a person's lifetime. Depending on the nature of the interventions, these changes can result in a few hours, days or months of life expectancy gain.

For a cost-befit analysis/WTP-based assessment of these interventions, it is necessary to place a monetary value on these life expectancy gains. This paper assesses the efficacy of a protocol designed to elicit a Value of a Life Year (VOLY) from air pollution reduction in a contingent valuation study. In line with the use of the contingent valuation method elsewhere (see, for example, its use in the environmental domain, where the first use [Davis, 1963] estimated the recreational use value of Maine woodland contrasts with contemporary studies valuing biodiversity preservation, flood control and so forth) the type of health goods valued have become

increasingly complex and technical in nature. This almost certainly means that respondents will be unfamiliar with them, will have little or no knowledge of their scientific attributes and maybe unsure of the nature of the benefits they bring, let alone their value.

The health good considered in this study – improved life expectancy arising from very small, ongoing reductions in the risk of death from reductions in air pollution – can be considered complex, not least because in this case it is an environmental project that generates the health benefit[1]. In addition, we may expect peoples' values to be influenced by their risk preferences since the good is an 'expectation', as opposed to a 'certainty', and also their time preferences, since much of the benefit accrue later in life. If these values are to be interpreted as a robust reflection of their preferences for such a good it is important that they are able to take account of these aspects to influence their valuation process. A further confound will arise if survey respondents articulate the small reductions in the risk of death that occur from the intervention and last throughout their life as merely a small amount of time added on at the end of their life, most likely in relatively poor health.

Given the complexity of the good, we believe that the only feasible approach to judging a contingent valuation protocol for a VOLY is its efficacy as a 'value construction' tool. We thus adopt Payne *et al.*'s (1999) constructivist interpretation of an elicitation procedure as a starting point from which to develop a framework by which to judge the VOLY protocol developed in a previous study (Chilton *et al.*, 2007). They argue that a central role of any elicitation procedure is to aid the respondent in arriving at 'well constructed' preferences and, secondly, that respondents must give through consideration to the most critical information. Our interpretation of this is that while non-critical information may be considered it must not unduly influence the valuation itself. Payne *et al.* (1999, pp. 255-6) define irrelevant information as exogenous considerations such as survey design characteristics or framing. In the context of this study we will extend this somewhat to encompass concerns that are endogenous to the good that is delivered by the policy and of interest to the commissioning body (life expectancy gain) but may nonetheless enter respondents' frame of reference when they consider how the good is delivered (via reductions in air pollution), such as the environment and quality of life.

As a further criterion, in order that any information is given due consideration, respondents would ideally be able to demonstrate some understanding of it. The normative question of 'how much?' is left to the discussion at the end.

We adopt a qualitative approach to assessing the VOLY protocol and, by extension, the resulting values. Baker *et al.* (2008) note, in contrast, the relative paucity of in-depth, qualitative studies that have been carried out with the aim of better understanding willingness to pay (WTP) responses (and the reasons for inconsistencies or anomalies in quantitative data). They identified only 34 papers for review, of which only 21 papers satisfied their criteria. Considering the contingent valuation approach more generally, it would be unfair to suggest that practitioners are unaware of the problems associated with the method – witness such studies as those

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[1] And of course, environmental benefits. The possibility arises that people value these offer a wTP that reflects these preferences.

on scope sensitivity (Carson and Mitchell, 1993; Bateman *et al.*, 2004; Olsen *et al.*, 2004), test-retest reliability (Boyle *et al.*, 1995) and reducing hypothetical bias (Cummings and Taylor, 1999) to name but a few are indicative of concerns – as the method developed and increased in usage – surrounding the reliability and validity of the resulting WTP values. However, such studies focus on the quantitative characteristics of the responses and tell us little, if anything, about how they might fare in respect of Payne and Bettman's criteria outlined above. This is the focus of the study reported below (quantitative results and tests are reported in Chilton *et al.*, 2007 and will not be elaborated on further).

Firstly, in the most basic sense, did respondents 'buy what we sold'? In other words, did our protocol provide sufficient information and a meaningful interpretation of it to communicate to respondents that the gain in life expectancy is a result of cumulative changes in their chances of survival over their lifetime? Further, that the changes in life expectancy begin almost immediately on inception of the policy, but that much of the benefit accruing later in life? The implications of this are twofold – namely, that the benefit is not certain and that it is not an 'add-on' at the end of life.

Secondly, what factors did respondents take into account in the construction of their WTP values? In other words, did 'correct' attributes e.g. the cumulative and uncertain nature of the gain feature as important considerations, if at all? Were they considered in exclusion to or in conjunction with *a priori*' 'irrelevant' attributes?

Taking the two together should permit us to make some assessment of the protocol. In this paper we report the results of a follow-up, qualitative study which was designed to address the two main issues above. It should also allow us to make some overall assessment of whether the intensive approach developed and implemented in the preceding quantitative study was to any degree 'worth it' compared to a less in-depth approach to information presentation such as one in which we simply informed respondents that the gain in life expectancy for the average person is X months. For example, if respondents fall short on all counts then so has the protocol. Likewise, if it succeeds on all counts, then, again, so has the protocol. A 'grey' area of course exists if it delivers on some but not all counts, or partially delivers on all counts. We return to this discussion later in the light of our findings.

Given the nature of the sample (UK and Poland) we are also able to draw some preliminary inferences on whether a 'one-size fits all' approach – whereby one survey is used to elicit a VOLY or Value of Statistical Life across a number of countries (exemplified by Desaigues *et al.* 2007 and studies by Krupnick and colleagues [Krupnick *et al.*, 2002, 2006; Alberini *et al.*, 2004]) is adequate. It may instead be the case that cultural concerns dictate some degree of customisation.

The remainder of the paper is as follows. In section 2, we present a brief description of how changes in air pollution lead to change sin life expectancy and provide a summary description of the mechanisms used to communicate the attributes of the good deployed within the Chilton *et al.* (2007) protocol. Section 3 describes the main methods employed in this qualitative study and Section 4 reports the results. Sections 5 and 6 discuss and conclude, respectively.

2. Describing a Gain in Life Expectancy from Air Pollution Reduction

Respondents participated in relatively intensive sessions which were moderated by a member of the research team with assistance, lasting about 1 hour and 20 minutes, of which approximately 35 minutes was devoted solely to an explanation of a life expectancy gain and how it is derived.

In the first stage, participants were introduced in a small group setting to the general nature of the study and the particular health impact of air pollution that they would be dealing with, specifically chronic effects from ongoing exposure leading to the possibility of premature death. This part of the session was interspersed with general open-ended questions and discussion on issues such as the causes of air pollution and why and how air pollution had different affects on different age groups. It was explained that as people age their risk of dying from air pollution increases, so while everyone is to some extent vulnerable to the effects of air pollution, this vulnerability increases with age and is much higher towards the end of the average person's life.

The section of the protocol dealing with the definition of the good was devised, with input from members of the public, in an attempt to convey, at least intuitively, to people the essential nature of the way in which this average gain is actually achieved and how, in turn, this translates into a gain in life expectancy[2]. Early piloting had indicated that a graphical presentation fared best as an information presentation mode, provided they were accompanied by clear verbal descriptions of the information portrayed in the graph. The description was provided via a series of diagrams based around a so-called 'ability to survive' curve which depicts the physical ability of the body to survive as a person ages. It simply reflects the intuition (and fact) that as we age, we become more susceptible to illnesses and accidents until at some point we can no longer expect to survive[3]. Figure 1 shows such a curve for an average 20 year old.

Figure 1
**'Ability to Survive' Curve (Average 20 Year Old)**

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[2] Ideally, in order to achieve a 'scientifically correct' understanding of the good - one would inform respondents of their change in conditional probabilities throughout their (expected) life. This approach was attempted in an earlier pilot study within Chilton *et al.* (2004) and deemed infeasible within both resource availability and severe cognitive limitations – well documented elsewhere – regarding peoples' cognitive capabilities in respect of processing small probabilities.

[3] Underlying this is the formal concept of an individual's survival function which embodies his or her conditional probabilities of survival as they progress through life. At some point, this falls to zero – perhaps around 120 years (although most people will have died well before then, hence life expectancy for our hypothetical average 20 year old is 78).
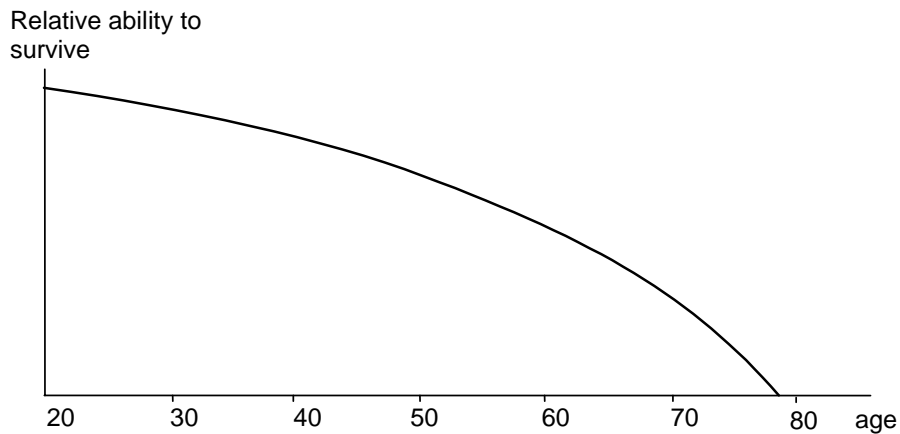
This was followed by a qualitative description of how a reduction in air pollution impacts the curve i.e. shifts it outwards and upwards. It was emphasised that the smaller the risk reduction the smaller the shift. To the extent that this pictorial representation displayed an increasing vertical gap between the original and the post - pollution reduction 'ability to survive' curves and hence indirectly the original and the post - pollution reduction survival curves- which is precisely what would result from an ongoing proportionate reduction in the hazard rate - we believe that respondents were provided with as clear and accurate an explanation as they were able to handle.

Figure 2
'Ability to Survive' Curves Following Different Reductions in Air Pollution
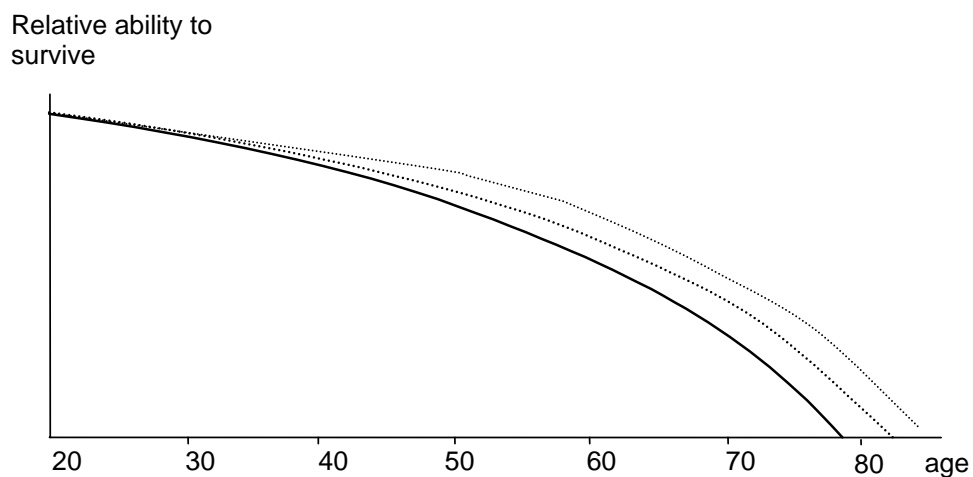

It was stressed that while most of the risk reduction (or increased chance of survival), and hence the effect on life expectancy, occurs towards the end of a person's life, *conditional* on them reaching this stage, some benefit accrues immediately the risk reduction is implemented[4]. A full explanation was also provided on the need to maintain lower levels of air pollution (and hence an increased cost of living) for the

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[4] It was also pointed out that the change in expected age of death was magnified for illustrative purposes and did *not* constitute the addition of a substantial number of years at the end of life.

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whole of one's life, if the full benefit in terms of life expectancy gain was to be realised (Figure 3). As a further check within the discussion, respondents were asked what would happen to air pollution levels and hence the 'Ability to Survive' curve if the higher level of expenditure ceased at point A and current levels resumed[5].

Figure 3
'Ability to Survive' Curves Following a Return to the Original Cost of Living (and Air Pollution)

Relative ability to
survive
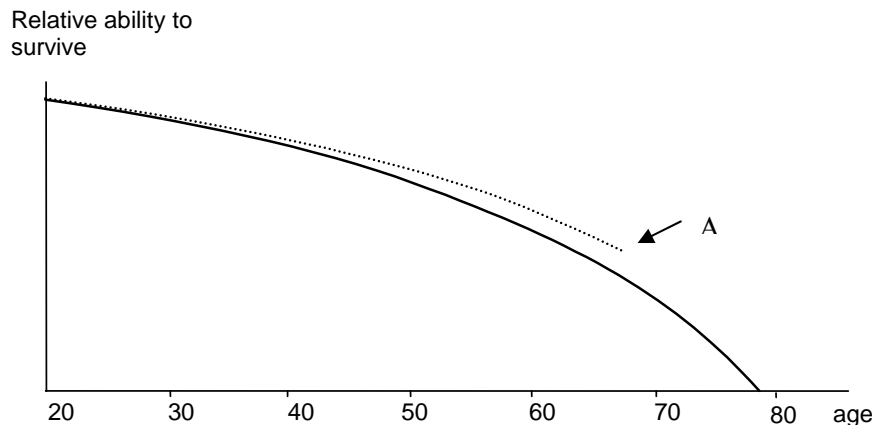
Whilst it is certainly true that policymakers only have evidence as to how an individual's gain in life expectancy would differ from the average and hence would use the average in any calculations in of aggregate life expectancy gains, it seems possible to us that an individual's WTP for the gain might be affected by how they perceive themselves relative to the average.

Therefore, following the explanatory and familiarization exercise, the focus group protocol then moved away from consideration of the average person, who could expect to be in average health along his/her 'ability to survive' curve, to consideration of each individual's own particular circumstances. Participants were asked to consider the health state of an average person and how that might be expected to change over time. They were then asked to rate themselves in relation to the average person. Information was provided on how any air pollution reduction might affect people of average, below average and above average health in order to highlight the uncertainties that surround an individual's gain in their own life expectancy.

Participants were also reminded that when they were thinking about themselves things can become even less certain. Depending upon their health, genetic make-up and general lifestyle and lots of other things, including where they live, the effect of air pollution may have a much greater or much smaller impact on them individually.

Taken together, relative health status and individual characteristics combine to the extent that the shift in an individual's 'ability to survive' curve and hence his/her life expectancy gain may differ significantly or otherwise from the 'average' person.

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[5] The correct answer is that it would approach but not coincide with original life expectancy. Initially, some respondents answered this correctly while others did not and further clarification was provided as necessary.

While this effect cannot be quantified, by explaining the uncertainty surrounding her own gain, an individual may, if she wishes, take it into account in his or her valuation.

The protocol then moved to the final WTP elicitation phase (see Chilton *et al.*, 2007 for details). Care was taken in relation to the associated exercises to ensure that all respondents in all groups had access to the correct factual information at the end of the process, irrespective of what might have been said in any one individual group. All WTP questions which would form the basis of the subsequent VOLY calculations were answered on a strictly individual basis.

In this particular protocol, no explicit attention was drawn to potential confounding, exogenous issues, in the sense of providing exercises or reminders to help respondents disentangle any of these from their valuation. This approach was based on previous experience whereby introducing them seemed to put them in the mind of at least some respondents. It was hoped that the intensive emphasis on the individual and the description of the good would dominate to at least an acceptable degree the respondent's thoughts and decision making, given the valuation exercise followed immediately, thus minimising, if not erasing, their impact. This issue will be revisited later in the paper.

The next section outlines the methods employed in the qualitative validity study.

3. Methods

Respondents were recruited by a market researcher in the two countries to represent a reasonably broad based cross section of the populace (approximately 50% male/50% female, 50% above 40 years of age/50% below 40 and involved in a range of occupations) in Newcastle upon Tyne and Warsaw. They were exposed to the same procedures, information and questions as those in the earlier quantitative study. Group size depended on interviewer availability, but ranged from two to five participants.

Data collection

For piloting purposes, a draft qualitative interview procedure was designed by all team members in Newcastle upon Tyne and developed and administered on 6 respondents, prior to administration on 22 respondents. UK data collection was observed by AB. AB subsequently piloted the protocol on 6 respondents in Warsaw, advised by SC. The results of the pilot Polish study indicated that no substantive changes would be required prior to full administration on 25 respondents.

Data for the qualitative study were collected via in-depth, individual semi structured interviews, based on a discussion guide (Appendix) supplemented as appropriate by further questions from the interviewer to follow up specific comments or observations by the respondent. Thus, while the topic guide fulfilled the role of a common core framework for all discussions to generate the type of data necessary to answer our specific questions in respect of the protocol, it was flexible enough to accommodate new themes or issues as they arose. Each interview was digitally audio recorded and transcribed verbatim and any notable interruptions, hesitations, nervousness or emotions such as laughter were noted.

In respect of the attributes focused on during the valuation exercise piloting suggested that people found it difficult to recall or report unprompted all attributes they had considered while formulating a valuation. Partly to reduce the cognitive difficulties associated with this task and partly to ensure that we obtained data on certain key attributes central to the (scientific) definition of life expectancy, we devised a 'card-sort' procedure whereby respondents were asked to sort a pack of 13 cards listing a mix of key attributes (*my budget; my increased ability to survive; my health and genes; number of months; paying for the rest of my life*) and exogenous, but potentially important to respondents, factors (*effects on other people; other information I have heard about air pollution; the level of air pollution where I live; my quality of life; whether air pollution policy will work; environmental issues; my general luck in life; my risk of dying from air pollution*) into three piles corresponding to their importance to the respondent when constructing their WTP[6]. These three piles were "Considered" Important, "Did not Consider Important" and "Did Not Consider but Seems Important Now" Once sorted, respondents were asked to say a little on those that were important and key cards that were not mentioned (i.e. why they did not consider them)..

Data analysis

Transcripts were imported into NVIVO qualitative software (QSR 2007) and a series of attributes were associated with each transcript (age, gender, WTP values, country). . Analysis followed standard qualitative procedures i.e. following initial familiarization with the transcripts by re-reading and listening to audio recordings, data were sorted, ordered and indexed. Early coding was carried out by all team members on an initial subsample of transcripts to derive a coding frame that was suitable for use with UK and Polish interviews. Each interview transcript was then coded by one of the authors and a small subsample (6) was coded by two researchers to ensure consistency. Further iteration occurred through ongoing discussions between SC and AB of emergent themes, ensuring that the coding scheme was both relevant to the research questions and grounded in the data.

Themes were built which were subsequently mapped and linked enabling us to interpret respondents' understanding of the information and their valuation processes. These steps were iterative and often employed simultaneously as opposed to consecutively. Deviant case analysis, also called constant comparison was used as a technique to critically consider thematic categories. This derives from grounded theory (Glaser and Strauss, 1967) and involves the search for examples of cases which do not fit with emergent themes. Using constant comparison, themes are revised with new evidence to incorporate concepts from negative cases, or new themes developed.

4. Results

The analysis reported here is based on the pooled qualitative data from the two studies. Quotes illustrating our findings are identified by a respondent's age, gender, WTP amounts and country.

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[6] It was not possible for a respondent to identify which group a card came from and hence it was hoped no signal was sent out regarding our views on their supposed importance or otherwise.

The two issues raised in the Introduction serve as our framework for the interpretation and analysis of the data. Thus, we explore firstly how respondents perceive the process by which life expectancy gains are realized i.e. the 'cumulative' nature of the gain and, secondly, whether they distinguish between the two types of uncertainty surrounding the gains (in the sense that they might die prematurely from some other cause and the actual gain for any one individual may or may not be the average gain)[7]. We also investigate the attributes of the good that were considered important to respondents when constructing their WTP values, as well as any exogenous concerns that they brought to the valuation task.

Respondents' Understanding of a Gain in Life Expectancy

Cumulative Gains

If respondents do not articulate some grasp or intuition as to the cumulative nature of the generation of life expectancy gains, then we must draw the conclusion that they did not understand the good and hence did not 'buy what we (thought we) sold. As such, even if their responses were economically consistent under the usual criteria (scope and so forth) their validity as a measure of the respondents' preferences for life expectancy gains from air pollution reduction is at best questionable.

There are two key aspects to consider when judging this. First, how do they explain or describe the attributes of the good (outlined in Section 2) and, further, what type of evidence might constitute a sufficient understanding of how these attributes combine to generate the gain? Both require value judgments on the part of the analyst, particularly the latter. At the very least we would hope for some acknowledgement that the gain is year on year changes in the probability of surviving but, most importantly, it is not a certain add-on at the end of life.

Secondly, the uncertain nature of the good should be alluded to. Ideally, this would encapsulate both the uncertainty surrounding both the receipt of the gain and its duration. Individual (genetic or health) characteristics might also increase the uncertainty, although the degree to which this might be a factor is unknown both to the respondent and researcher, making it very difficult to convey in a survey.

Turning to the evidence in respect of these aspects

There is evidence in the coded, interview transcripts that these notions had been absorbed by many of the respondents, who considered the concepts during their valuation tasks and explained them as part of their reasoning when discussing their valuations during interview. Of course, the 'cumulative nature of the gain in life expectancy' is rarely described in exactly those terms in respondents' accounts. This is unsurprising since, although the notion was described to respondents using visual aids and examples as described above, we avoided technical terms. Nonetheless an

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[7] This is not meant to imply that the two are independent attributes, since they clearly combine to deliver a life expectancy gain. However, we were unable to derive a meaningful question that allowed a respondent to report their understanding of the joint impact. As such, there may be some shortcomings in our collected data.

appreciation of the cumulative nature of the gain can be detected in respondents' more colloquial references such as "gradual" or "stretched out":

> *"I know it would be stretched out over the time"*

1 month=£25; 6 months=£100; female; 48 (UK)

> *"It's a gradual decline in my health that would catch up with me at the point of 72. Therefore, those gradual benefits I've gained throughout the years of my life, it has compounded and added onto the end."*

1 month=£0; 6 months=£50; male; 33 (UK)

> *"It will take a few years for it to happen though. I mean, say they, say they brought it [air pollution policy] out next year, then I'd probably gain the six months towards the end of my life."*

1 month=£0; 6 months=£15; male; 21 (UK)

In comments such as the above, while these respondents certainly seemed to notice the gain was not at the end of life, there is little explicit evidence that they had taken on board the fact that the distribution of this gain is not constant but is in fact increasing. However, there is evidence elsewhere that at least some respondents grasped this intuition:

"I'm 21 and I know if I stared to pay now than being 70 I could actually live longer around 6 month or more. So I know if I were older my chance would be smaller, if we assume that environmental pollution for sure would influence my life, so .. I would say that it would be each year somewhere this additional day..."
1 month = 0 PLN; 6 months = 300 PLN; female; 21; (PL)

"I think it is the matter of the survival curve explanation. It shows that is 6 months at the end of life. But it is possible to explain that as 4 months more at the age of 45. Because it's not like that that you need to survive 70 years to get 6 months more. It's possible to live only until 40 and get than proportionally less, I do not know 4 or 5 months."
1 month = 100 PLN; 6 months = 200 PLN; male; 29; (PL)

"I think it is a life extension. Through the whole life period. Cause in this year I could get 1 day, in one year 2 days and so on."
1 month = 300 PLN; 6 months = 1500; female; 50; (PL)

On a more cautionary note, some respondents appeared to change their mind about the manner in which the gain in LE is delivered during the interview (particularly if probed with a direct questions such as "Do you think, that you would get those X months at the end of your life?"). To an extent this might be expected, given peoples' unfamiliarity with the good (and, indeed, part of the point of the extensive information provision exercise is to correct peoples' misperceptions):

"Now when you asked me this question, I start to change my way of thinking. But first... through the whole survey, I thought like that (AB: 6 months at the end of life). Last 6 months and this ending, but it is true, if you think more deeply, that these 6 months affect all my life, somehow in minutes."
1 month = 300 PLN; 6 months = 300 PLN; male; 40; (PL)

"It means when I was thinking about that, I was thinking that at the very end of my life I would have these 6 additional months. But I think, that if I talk about that with someone, I suspect, that I would try to show that he/she would get those days every year, somehow longer. Summing up we do not know if we will live till 60, 80 or 30. But it's beneficial for a 40 years old as well – he/she would get something from it."
1 month = 60 PLN; 6 months = 300 PLN; female; 21; (PL)

Some respondents interpreted the way in which the increase in life expectancy would be accrued as a result of an increase in ability to survive over a period of time. This was often described in terms of strength, or fitness, not suffering illnesses so frequently or physically deteriorating so quickly. This is clearly a quality of life issue, and will be further discussed in that context later, but we provide an illustrative quote here:

> *"..if you have got a higher chance of survival then you might get more of the benefits on top for longer. So if you do get to that stage you'll obviously be able to fight it better or just be in a better, in a healthier state."*

1 month=£25; 6 months=£100; female; 48 (UK)

However, a minority of respondents[8] described the cumulative gain in a way that conveyed an incomplete understanding of this aspect of the good. Essentially, these respondents viewed it as additional life added on at or near the end i.e. an 'add-on'. Such heuristics could indicate a lack of insight into the mechanisms through which the gain in life expectancy is supposed to accrue as well as the fact that it is life *expectancy* and not *life* that is extended:

INT: Yes, but what would you have described to him in the first place?

RESP: Well, I would have said if I pay if I live until I'm 80 I'm going to live an extra 11 months.
1 month = £100, 6 months = £100; female; 43 (UK))

INT: Some people have described it as an additional 6 months at the end of their life. Would you agree with that?
RESP: For me – yes. I have been living for 58 years, so for me yes."
1 month = 0 PLN; 6 months = 600; female; 58; (PL)

RESP: I'd probably going I think it would be 6 month. Say when I was going to die – oh, I've got another 6 months kind of thing. Do you know what I mean?
1 month = £0; 6 months = £20; male; 39; (UK)

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[8] For example, 80% of the Polish sample disagreed with the statement that the gain would be at the end of their life.

Nevertheless, others were clear that the gain in life expectancy should not be seen as a tagging on:

> *"INT: Some people have described it as an additional 6 months at the end of their life. Would you agree with that?*
>
> *RESP: No, as I said, it's not a tagging-on. If you see it like that, like I'm going on holidays, then I'll pay it for an extra 6 months and I'll take it whenever, ah you're going to die and here's another 6 months, I'd say it's not."*

1 month = £0; 6 months = £20; male; 22; (UK)

Uncertainty

While some respondents mentioned more than one type of uncertainty, in general the tendency was for a respondent to concentrate only on one type, at least in the UK. As such there is very little overlap and a respondent, if they consider uncertainty seem to focus on one type. There was a more noticeable tendency in the Polish sample to combine the first two types below, in the sense that about 60% underlines the fact that life expectancy is uncertain. A reasonable number of respondents compared themselves to the average and/or noted that others may be affected differently. Of those that did mention this aspect, all but one showed what might be considered a good or reasonable understanding The most common type of uncertainty mentioned is the uncertainty of the length of gain,

RESP We can not expect that we get these 6 months cause we paid, no one can guarantees that…, it could be 6 or 5 months but we shouldn't treat them as additional ones. Life is unique. It could last 17, 20, 30 or 79 years"
1 month = PLN; 6 months = PLN; ; ; (PL)

RESP Again, I thought 6 months was worth having but there gain I said that that perhaps for somebody who was below average they although they may gain the average it may be less than that so I was thinking there was enough uncertainty for me with one month that I was thinking, well, it could be a couple of weeks and you know the actual variability between people is wide so I don't know what's happen to me. I'm realistic.
1 month = £25, 6 months = £100; male; 45;   (UK)

while a smaller number mentioned the uncertainty of receiving any gain:

INT. How about 'my health and genes'? How did that influence?

RESP. Because I've got cancer in my family so I could be paying what I considered I could be paying £4 a month and die young anyway.
1 month = £100, 6 months = £100; female; 43 (UK)

INT: yes. Did that influence how many months you thought you would get. As Hugh explained you could get more than 3 or less than 3 months. Did you think about that?

RESP. Well, its I thought of that as my health and genes and I kind of think, no, I'll probably have a heart attack or stroke because that's what's in the family. It' sin the family because my mum does the family tree and she gets death certificates all the time and there all heart attacks and strokes, heart attacks. So, with this kind of thing, would it be worth paying a lot of money for a month or year when I'll probably have a heart attack anyway (laughs)
1 month = £25, 6 months = £100; female; 48 (UK)

In the UK (above) this was generally in connection with family health and genes and/or health history, while in the Polish sample, people tended to connect the uncertainty more to external risks, such as car accidents, crime or fate:

RESP: If I am not going to die in a car accident when I am 40, that... in theory..., so I will die, it is a fact... but life quality from when I am 20 till 40 would be better, I would have less illness, on each stage of my life."
1 month = PLN; 6 months = PLN

and its distribution:

RESP: Nobody knows for sure how long he would live, so it is not known when these 6 months would be these 6 months, when would be that 5, 4, 6 or 2 or 1. It is hard to describe"
1 month = PLN; 6 months = PLN; ; ; (PL)

RESP: It could be longer life but not necessarily about half a year. E.g. 1 year but it could also be 3 months only and not at the end of life, only...., it is increasing the youth."
1 month = 12.5 PLN; 6 months = 25PLN; female; 26; (PL)

RESP I'm 21 and I know if I stared to pay now than being 70 I could actually live longer around 6 month or more. So I know if I were older my chance would be smaller, if we assume that environmental pollution for sure would influence my life, so .. I would say that it would be each year somewhere this additional day..."
1 month = 0 PLN; 6 months = 300PLN; female; 21; (PL)

A few respondents, somewhat incisively, noted the fact that you would not actually know when or if you had received it:

Field notes: After the tape switched off the respondent said: after all, you wouldn't even know if you had got the 6 months would you? So if you'd been paying there's be no one to get back to, to thank or otherwise.
1 month = £20, 6 months = £100; female; 70 (UK)

INT: Some people have described it as an additional 6 months at the end of their life. Would you agree with that?
RESP: Not necessary. It is possible, but it could be in any moment."
1 month = PLN; 6 months = PLN; female; ; (PL)

RESP: Nobody knows for sure how long he would live, so it is not known when these 6 months would be these 6 months, when would be that 5, 4, 6 or 2 or 1. It is hard to describe."

1 month = PLN; 6 months = PLN; female; ; (PL)

Finally, some respondents considered that the uncertainty was due to the impact on health/genes and/or quality of life. In these type of responses it seems clear that respondents have either concluded that the air pollution will have had a substantive impact on health and/or quality of life over the years and thus they will have a better chance of enjoying the gain. This issue is considered further in the quality of life discussion in the section concerning exogenous concerns, since it is outwith the definition of uncertainty as adopted here.

We now turn to the attributes and considerations that respondents focussed on in arriving at their WTP values.

Important Attributes Affecting WTP

We now consider the second major question of interest, namely which attributes did respondents consider when valuing the life expectancy changes an dhow, in a qualitative sense, did they take them into account? As noted in Section 3, these attributes comprised a range of key and non-key attributes. The former were predefined by the researchers (based on the scientific characteristics of the good) and by implication, the more that are considered the potentially more reliable and valid the valuation. The latter were identified as potentially important to respondents. Their inclusion as an important attribute may or may not affect the validity of the estimate.

Table 1 highlights the different emphasis placed on each attribute by the two samples of respondents. For example, card 1 'my budget' was mentioned by 80% of the Polish sample and 96% of the British sample i.e. a 20% difference in emphasis.

Table 1 Percentage of Respondents Indicating each Attribute as Important

Cards	Respondents (%)		Difference (%)
	British(1)	Polish (2)	((2)-(1))/(2)
1* - my budget	96	80	- 20
2* - my increased ability to survive	52	58	+ 10
3* - my health and genes	74	68	- 9
4* - number of months	79	58	- 36
5* - paying for the rest of my life	66	51	- 29
6 – my risk of dying from air pollution	48	20	- 140
7 – my general luck in life	9	13	+ 31
8 – the environment	37	31	- 19
9 – whether air pollution policy will work	39	37	- 5
10 – my quality of life	70	66	- 6
11 – the level of air pollution where I live	30	60	+ 50
12 – other information I have heard about air pollution	18	28	+ 36
13 – effects on other people	26	47	+ 45

More interesting perhaps though is the information in Table 2, which details how the respondents in the two countries ranked the cards in aggregate. This provides us with a potential 'route-map' for our qualitative analysis.

Table 2 Card Rankings (Most to Least Important)

Sample	Rank Order of Cards
British	1, 4, 3, 10, 5, 2, 6, 9, 8, 11, 13, 12, 7
Polish	1, 3, 10, 11, 2, 4, 5, 13, 8, 9, 12, 6, 7

A cursory glance at Table 2 tells us that the five key cards were ranked in the top six in the British sample, while for the Polish sample the corresponding figures are five in the top seven. *Prima facie* this might be taken as a positive sign, potentially signaling a reasonable level of validity although we return to this point later. First, though, we focus on the obvious prominence of card 10 'my quality of life'. This is potentially worrying, since 'scientifically' speaking, it should not be there. We then move on to a consideration of the difference in importance of cards 6 'my risk of dying from air pollution (raked 6th in importance in the British sample but 12th in Poland) and 11 'the level of air pollution where I live' (ranked 4th by the Polish sample and 10th by the British respondents).

Consideration of 'my quality of life' (card 10) has the potential to inflate WTP. These concerns were often health-related, sometimes in respect of other people:

RESP: I would say to help everyone, not just me personally. This £100 I'd help everyone to an extra six months, or six months of better quality of life rather than. I think the quality of life is such an important thing you know.
1 month = £20, 6 months = £100; female; 70 (UK)

INT: How about 'other information I have heard about air pollution'.

RESP: Well just how it affects your breathing. People with asthma and different things that I would take into consideration. If people like air pollution give you an asthma attack I would think well that would mean I'd paid this poll tax to keep the streets clean but the air dirty. So you know what I mean (laughs)?
1 month = £100, 6 months = £100; female; 43 (UK)

RESP: I decided to take that from the egoistic point of view and above all I took my health into account. If there was such possibility that the pollution would not reach us things would be different in the future, our organs would last longer."
1 month = 0 PLN; 6 months = 150 PLN; male; 30; (PL)

RESP: For sure we can gain something through life, cause when pollution decreases, we would feel better and daily life would improve. We would be healthier, so we would benefit all the time.
1 month = 0 PLN; 6 months 30 PLN; female; 25; (PL)

The most frequent reference to quality of life occurred in the context of later life/death. A number of respondents noted that the state of their health (and associated

quality of life) at the end of their life (or at the age of death) would influence how beneficial they considered any gain in life expectancy to be[9] (the effect on WTP is unclear, but could be deflationary if a respondent was pessimistic about their health as they age) e.g.:

RESP: But how do you know you want another 6 months, you know. I might have a terminal illness or something like that. Your wife might have just died and you'd think well I don't want to live any more. These things can go on in your mind when you are older. You see some old people and you think Jesus, I don't want to be like that and then somebody all of a sudden says you've got another 6 months.
1 month = £0, 6 months = £0; male; 59 (UK)

RESP: It means .. I was thinking how much I could enjoy my life, it that sense, that I will not be a "vegetable", or a problem for others, but I would be able to live in a normal condition... I was thinking, if I could do something,....., this connection is not so direct, it means I thought that for these 6 months I would be in a better condition, so that my life would not finish in "a complete emptiness" and a vegetable, only that I would have a few additional months, I would say, of more or less good life. I know what I say is not clear ...
1 month = 0 PLN; 6 months = 3000 PLN; male; 40; (PL)

The contextal impacts of air pollution context were captured by two cards "My risk of dying from air pollution" (card 6) and "the level of air pollution where I live" (card 11). In the case of the first card some respondents in the British group underlined the fact the this risk is a marginal one e.g.:

INT: No. OK. And finally you wrote down 'my risk of dying from air pollution'.
RESP: It was considered but it was the least of my worries due to my personal belief that it's a very, very small percentage that can be affected. That will actually die from air pollution.
1 month = £25, 6 months = £50; female; 47 (UK)

In both the British and Polish samples, there were some respondents for whom this card was strongly connected with card 2 "my increased ability to survive" e.g.

RESP: Less pollution means smaller risk of dying. It means longer life. It is why it is the same for as "my increased ability to survive". It is a king of game. I pay, and since this moment I have higher chances to survive.
1 month = 300 PLN; 6 months = 1500 PLN; female; 50; (PL)

RESP: OK. Right. Great. 'My risk of dying from air pollution'? I guess that goes along with survival really. Or your increased survival rate. It's how much your risk is now. It's probably higher living in a city than living elsewhere. You know, probably more air pollution.
1 month = £0, 6 months = £50; male; 33 (UK)

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[9] In all quotes of this nature, people tended to refer (perhaps colloquially) to an 'additional' 6 months even if the evidence elsewhere in the transcript indicated some degree of understanding of the cumulative nature of the good.

In addition, some of Britsh respondents explicitly linked those two aspects together e.g.:

RESP: Yeah. I reckon the North East is not really that high in air pollution compared to, well , er, Middlesborough they've got it really high air pollution but there's a lot of factories there and stuff. The factories have gone from here and in Newcastle. So the risk of dying from air pollution is low. I mean like on a death certificate or something, cause of death: air pollution. I don't think that
1 month=£0, 6 months = £15; male;   21   (UK)

It is notable that more Polish respondents considered the level of air pollution where they live as an important factor in their valuation process. They underlined the fact they live in a large city[10] with heavy traffic levels and significant industrial activity. Some of them mentioned the quality of life in this context e.g.:
.
RESP: Definitely the air pollution level matters. I live in a big urban agglomeration so it's more related to me than to the people living on the countryside or in cleaner part of Poland.
1 month = 0 PLN; 6 months = 540 PLN; female; 35; (PL)

RESP:In the surrounding are where I live, there is not any big industry. But a traffic is quite heavy. On the other hand is not so bad is in Silesia region.
1 month = 50 PLN; 6 months = 300 PLN; female; 21; (PL)

At the same time some British respondents mentioned that place where they live is relatively clean environment e.g.

INT: And what about this one: ;air pollution where I live'?
RESP: The affects are not too bad where we are compared to where I used to live so I'm not actually there during the day, at school a long time so not sort of too bad.
1 month = £25, 6 months = £100; male; 45;   (UK)

INT: OK. And finally 'the level of air pollution where I live'.
RESP:Yeah, depending where I live like whether you'd be bothered or not because if you don't have all this industry and stuff.
INT: Right.
RESP:so if I go back there to live there's a bit of work so there's not much air pollution or if I stay in a more polluted city so it all depends
1 month = £0, 6 months = £12; female; 21 (UK)

While all key cards featured highly in each of the rankings, any conclusions about validity should be drawn with caution. As ever, these attributes were often viewed differently by people, with differing implications for reliability. For example, while it is certainly true that for the majority of respondents the most important consideration was 'my budget' (card 1), this sometimes appeared to be a concern for their discretionary budget (an apparently endemic problem to all CVM studies). Related to this, is the length of the payment period (card 5) – sometimes this was accounted for

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[10] Warsaw has 2,000,000 inhabitants.

when arriving at a WTP, but often it was not even though it was identified as important in the card sort exercise.

People were generally cognisant of the 'number of months' (card 4), but felt that one month (a marginal change) was worth little if anything, while 6 months (arguably non-marginal) was worth something, perhaps hinting at some 'threshold gain' below which entry into any 'market' would not be deemed worthwhile e.g.:

INT: Good. What about the next card. You have 'number of months'.

RESP: Yes. I think I was just thinking about a month is neither here nor there really to me. And a month, the month at the end of your life, no, it wasn't going to make that much difference. The same with 6 months, although 6 months is better. You kind of think oh well 6 months, you know, it seems, you know, a better amount that's worth paying for, 6 months. You can do a lot in 6 months.. You think if you are going to be above average health so for 6 months. But a month is not a long time in the end.
1 month = £25, 6 months = £100; female; 48 (UK)

RESP: *For me these 6 months it is a level from which I would be willing to pay something. Smaller increases are not attractive. Giving the high level of uncertainty there are so "symbolic", that they do not move my imagination (slang – means they are not convincing).*
1 month = 0 PLN; 6 months = 300 PLN; male; 65; (PL)

Regarding 'my health and genes' (card 3) those that mentioned it often pointed to the potentially positive impact that these might have on the likelihood of enjoying the (life expectancy) benefits from air pollution reduction e.g.:

RESP: Well, its I thought of that as my health and genes and I kind of think, no, I'll probably have a heart attack or stroke because that's what's in the family. It's in the family because my mum does the family tree and she gets death certificates all the time and there all heart attacks and strokes, heart attacks. So, with this kind of thing, would it be worth paying a lot of money for a month or year when I'll probably have a heart attack anyway (laughs)
1 month = £25, 6 months = £100; female; 48 (UK)

But in some cases, a potentially negative impact was highlighted e.g.:

INT: How about 'my health and genes'? How did that influence?

RESP: Because I've got cancer in my family so I could be paying what I considered I could be paying £4 a month and die young anyway.
1 month = £100, 6 months = £100; female; 43 (UK)

Finally, whilst it only happened on a few occasions, some people did bring 'extra' elements into their valuations, for example 'the environment' (card 8)

INT: then you have the 'environmental issues'.

RESP: To be fair, I know this was going on me personally but I would want the reduction in air pollution for the environment more than for 6 months on my life.

and 'effects on other people' (card 13):

INT: And the last card, 'effects on other people'.

RESP: Ah to be honest I'm selfish. I was thinking of my family. I wasn't thinking of anyone else in the world. I'm always thinking of my family (laughs). So long as my sons and their wives and their future children, it's better for them.
<u>1 month = £100, 6 months = £200; female; 43 (UK)</u>

We conclude this section with a brief comment on the exogenous concerns which may have affected WTP. These are largely issues raised by respondents in the course of their answers. Some issues overlap with the WTP cards above but they are largely in a wider, more general context. They hint at a 'superframe' for the interview, in the sense that the respondent seems to be drawing on other, more familiar issues to contextualise the particular problem and/or find difficult to disentangle life expectancy gains as a separate attribute.

In the UK, quotes are observed across 14 of the transcripts. However, 64% of the quotes are generated by five respondents who tend to be 'repeat visitors' across categories supplying 4, 5, 6 or 7 quotes. A further 20% of quotes emanate from 4 respondents, who supply 2 or 3 each, across more than one category. 4 respondents contribute one quote each. One could take this as evidence (perhaps?) that on the whole the protocol was successful in terms of minimising the impact of these more general considerations, although substantial problems occur with a minority of respondents (these are discussed separately in the next section). While not widespread, it is notable that concerns such as scenario credibility or scepticism might lead to potential protests or severely deflated WTPs on the part of some respondents, in both this and future studies. Similarly, while warm glow is present in a few transcripts, it is not widespread. As such, for these types of issues, the protocol appears to have done a relatively good job in minimising their appearance/influence. Family altruism or other regarding preferences in general do appear, but only in a minority of transcripts. Quality of life was often referred to in a general sense as well as in respect of the WTP value above, often in response to the direct question '*Some people have described it as an additional 6 months at the end of their life. Would you agree with that?*', This is potentially important, since it suggests that, a number of respondents found it difficult to separate their preferences for this from their preferences over extended life expectancy. In the Polish case, though, quotes of this nature are observed in all transcripts, to varying degrees. As in the UK, some of these (15) were 'repeat visits' supplying three or more coded nodes across. Nevertheless, these exogenous concerns do seem more prevalent in the Polish sample.

Deviant Case Analysis

The purpose of this subsection is to identify the type of respondent who unambiguously did *not* 'buy what we sold', despite being exposed to the same information set and explanations as the others. The criteria that we choose to adopt for deviant cases is a 'yes' response to the direct probe "*Some people have described*

it as an additional 6 months at the end of their life. Would you agree with that?" combined with a coding to either one or both of two further nodes – life expectancy understood as an extra gain in life or life expectancy and life are the same thing (in other words, uncertainty is removed). e.g.:

INT: So you said you'd pay £X for say a 6 month gain in life expectancy. If you were to explain to a friend when you went home what you were going to pay for, how best would you describe it to them?

RESP: (laughs). Good question. I'd just say another holiday.
INT: That's what you wouldn't get. So the £250 a year. What? Why are you going to pay £250 a year?
RESP: Why am I going to pay it?
INT: Yes. What are you buying?
RESP: Well, life of course (laughs).
1 month = £0, 6 months = £250; male; 76 (UK)

INT: Some people have described it as an additional 6 months at the end of their life. Would you agree with that?
RESP: Yes.
INT: So 6 months at the end of your life.
RESP: yes. 6 months. 6 months you never had and that could make a big difference than a month.
1 month = £100, 6 months = £200; female; 43 (UK)

In some cases the transcript hinted at some understanding of cumulative gains, but this was a cumulative improvement in quality of life, the end result being 6 additional months e.g.:

RESP I think when I was doing those I thought it would be a better quality of life as well, you know, it would be a better quality of life and you may live an extra 6 months at the end.
INT: Because of the,
RESP: Because of the quality of life. Obviously you know you'd be a bit fitter and a bit stronger and maybe not ill as many times. So you would want the end 6 months to be healthy.
1 month = £25, 6 months = £100; female; 48 (UK)

Clearly, there is not a sharp divide between deviant and non-deviant cases, as might be expected. It seems that 4 respondents in the UK can be classified as such. If true, this would lead us to conclude that for most people, the level of information provided was suitable for the majority of respondents in a valuation study of the health benefits of air pollution reduction.

5. Discussion and Conclusions

The first point to make is that it must be remembered that respondents were not given an 'examination' about their understanding of all of the concepts explained to them. They were asked to explain their rationales for their responses and to identify the factors they took into account in formulating their valuations.   Interpretation of this

type of qualitative data is not straightforward for the following reason: failure to mention an important issue does not necessarily imply that it was not absorbed and understood by a respondent during the valuation task. There is the added possibility that notions that are perceived to be 'shared understandings' remain unspoken. For example, a respondent who is asked whether they expect to gain 6 months of life (in order to explore issues of uncertainty and expectancy) might reply 'yes' but not add 'if I live that long', or 'or thereabouts, it might be more or less than 6 months for me'. In anticipation of this issue, a number of prompts were incorporated into the interview schedule including the card sort as well a number of verbal probes. The qualitative analysis reports good and poor examples of respondents describing the good they were paying for. It does not count 'frequencies of mentions' and it would be inappropriate to draw conclusions from counts such as these. The card sort is designed to provide us with some quantitative information to supplement the qualitative data.

The choice of qualitative data generation methods in this study has implications for the interpretations of our findings. Two key issues are: the use of the card 'prompts' printed with factors that may (or may not) have affected respondents' construction of their willingness to pay values; and the selection of *a posteriori* interview methods as opposed to contemporaneous qualitative techniques such as think aloud methods. Both of these issues have the potential for post hoc rationalisation by respondents, or else subconscious re-framing of their thought processes as a result of the interview stimuli.

The use of card prompts in qualitative interviews has advantages and disadvantages. In contexts such as this, where respondents are asked first to undertake an unfamiliar and highly stylised task, and then to discuss their responses in some depth, we felt that some prompts/ aids would benefit the discussion. Importantly the arrangement of cards into four categories indicating whether they were important in the WTP values delivered some data for each respondent that could be directly compared. This was almost the first thing respondents were asked to do in the interview following the valuation exercise and so the results of the card sort are also 'unencumbered' by the subsequent discussion. Additionally, the cards provided a stimulus and a natural starting point for questions. Open ended questions (e.g. "what were you thinking about when you gave your responses") while arguably less leading bring to bear two potential problems. The first is that the data elicited may not be suitable for the particular research question and the second is that respondents may be reluctant to say much if they think there is a 'correct' answer. The factors listed on the cards represented an assortment of issues that were felt to be important by both the research team and the public (see Section 3 for details). The interpretation of qualitative data from such methods is made more difficult since we run the risk that certain factors, in particular, exogenous concerns (such as the environment or quality of life) responses are *introduced* into respondents' accounts *because* they are printed onto the cards. In that sense the impact of these factors may appear worse, based on our findings, than they actually are.

The use of *post hoc* interview techniques gives rise to specific limitations – in particular the possible elicitation of post hoc rationalisations - which are perhaps especially problematic when applied to explanations of responses to unfamiliar quantitative techniques. Respondents' accounts are unrehearsed and not previously

articulated.with the additional complexity that for most respondents, preferences for the life expectancy gains are actually constructed during the interview, as well as valuations. There are likely to be interactions between the two that would be difficult to verbalise. There may be a case made, in studies such as this, for qualitative data collection methods that take place simultaneously with quantitative data collection, such as 'think aloud' or 'cognitive interview' techniques in order to avoid post hoc rationalisation. After careful consideration we decided against their use since the quantitative exercises respondents were engaged in were already sufficiently complex. That the interviews immediately followed the focus groups means that there were no recall issues. The analysis presented here should clearly be interpreted in the light of the methodological limitations we have highlighted.

Turning to the some key messages arising from the data, an important finding appears to be that given sufficient time and effort (on both their part and that of the research team), the majority of respondents appeared to be able to process information of this level of complexity, to a degree sufficient to grasp the underlying intuition of how the gain in life expectancy is delivered. This reduced the impact of the add-on heuristic on aggregate values, an important advancement. Clearly, some people continue to view it as a simple add-on, but we would argue that our approach has helped at least some respondents overcome this misunderstanding, at least partially. Having said that, though, when considering the associated uncertainty, the evidence suggests that while the protocol was successful in conveying notions of uncertainty in general, once at the level of an individual, this understanding or acknowledgement became only partial and, in a few cases incorrect. Nevertheless, when understanding was demonstrated it seems reasonable to conclude that it accorded with the types of uncertainty surrounding life expectancy. The elicited value is hence more likely to bear some relation to their true value for the good.

Note that, we can say nothing about what respondents valued in other studies – indeed, with much less effort, other researchers may have conveyed the nature of the good perfectly adequately. We note though that in comparison with another UK study that values the same additions to life expectancy (Chilton *et al*., 2004) our associated quantitative study (Chilton *et al*., 2007) obtained different and higher values. Further research would be necessary before any comment could be made on respondents' definition of the good in the former study, but the tentative conclusion is that something different was valued in the two studies (from the respondent's perspective).

In respect of the econometric analysis of such data, the lesson we will take from this study is that it would be desirable to have scalar variables included to capture or control for the influence of exogenous, contextual variables, particularly in this case quality of life. It seems clear that context (in our case, air pollution reduction) helps people to understand the good (change in life expectancy) but the price the analyst pays is the effect of contextual factors on the valuation. Our conclusion is that this trade-off must be made, and that at least at this stage it is better to try to measure its impact than to try and reduce its impact *a priori*. This may be possible in the longer run, but would almost certainly require additional efforts in the pre-valuation part of a survey. Particularly in the case of complex goods where respondents may well be asked to process a great deal of information (as here) to help them conceptualise the good, the detrimental impact of cognitive overload and fatigue on the actual valuation may well outweigh any (possibly small) advantages from removing such contextual

effects. This is clearly an area for future research and cannot be definitively answered by the findings from this study.

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APPENDIX: QUALITATIVE INTERVIEW TOPIC GUIDE

• In the next part of this interview I'll be asking you to tell me a little bit about how you went about answering the various questions and what you thought about some of the information we gave you. By finding out this kind of information we can better understand people's answers and it also helps us greatly setting up future studies. **J**ust so that we do not to lose anything important I'd like to record this part of discussion as it is easier than taking notes. Is that OK? (*Turn **tape recorder** on). *As before, anything you say will remain anonymous.

"Just to start, what is you general feeling about the information given in the group and the questions as a whole? What did you think about all that: interesting, challenging? (open conversation, respondent directed)

III CARD SET A (Factors influencing value)

• In this next part I am interested in finding out more about what you were taking into consideration or thinking about when you were deciding the amount of money that you would pay for the gains in life expectancy – your answers to 7 a (and b).. In order to help you think about this, I will give you another set of cards to sort. These cards are based on what people have said to us, both in this study and others. Some people might take them all into account while others will have had their own reasons, not mentioned on these cards. What I want to know is which if any of the cards did you consider? There

are also some blank cards on which you can either write your reasons (if we don't have it them on our cards) or you can tell me and I'll write them in.

I should just say that the reasons on cards are in most cases described only very generally, since different people might think about the same thing very differently. (*pick out BUDGET card*). For example, this BUDGET card – some people might think about their own personal income whilst someone else may consider the money coming into the household as a whole. Some people might think about their weekly or monthly outgoings. Others may think about all these things. If you are not sure whether our descriptions cover your reasons just fill in a blank card and we can use that instead.

• Could you now sort these cards into two piles on this template (give respondent **template A** and **cards**). ***Please take each card in turn and, if you used the factor on the card to help you decide the amount you said you would pay when you were sorting out the money cards please put it in the 'Used `this factor' pile. If you did not think about it, put it into the 'Did not use this factor' pile.*** Please use the two other boxes for any cards about which you are either unsure about what they mean or if you didn't consider at the time but think are important now. *(if they start to talk about the card , instruct them to complete the cart and we will talk about them later)*

TEMPLATE A

Used this factor	Did not use this factor
Did not consider but it seems to matter now	**Unsure what it means**

MAKE A NOTE OF EACH SUBSET OF CARDS IN ALL BOXES ON TEMPLATE (NUMBER OF CARDS). DURING THE FOLLOWING DISCUSSION INSURE THAT IS CLEAR FOR THE TAPE, WHICH CARD IS BEEN TALKED ABOUT.

"Used this factor' CARDS

TAKE THE CARDS FROM "Used this factor" PILE (*=key cards)

DISCUSS WHY EACH CARD WAS IMPORTAN T AND HOW IMPORTANT, HOW THE USED IT ETC.

• Please rank the cards in order of importance. Put the most important card at the top, the second most important underneath and so on. If any were equally important put them side by side. [IF RESPONDENT EXPRESSES OR SEEMS TO BE HAVING DIFFICULTY RANKING THEM: If you find ranking them difficult, are you able to identify one or two that seemed more important? We can talk about those first and discuss the others afterwards]

USE GENERAL PROMPTS AS APPROPRIATE WITH EACH CARD (CARD NUMBER IN BRACKETS, CORRESPONDS WITH NUMBER ON BACK OF CARD)

[..] SOME ADDITIONAL ISSUES THAT COULD BE PROBED IF APPROPRIATE. NOTE THAT (2) AND (4) ARE DEALT WITH IN SECTION IV)

General probes:
Why was it important? In what way did that matter to you? What were you thinking about here?

(1) *MY BUDGET (money I have available to me) [
Personal? Household? Current income only? Future income considered?]

(2) * MY INCREASED ABILITY TO SURVIVE EACH YEAR

(3) * MY HEALTH AND GENES
[Did you think just about your own health or did you compare yourself to the average at all? Effect on expected length of gain.)

(4) * NUMBER OF MONTHS

(5) * PAYING FOR THE REST OF MY LIFE

(6) MY RISK OF DYING FROM AIR POLLUTION
[Relative size of risk compared to other causes of death]

(7) MY GENERAL LUCK IN LIFE

(8) THE ENVIRONMENT ISSUES
[Natural environment in general or living environment e.g. traffic pollution]

(9) WHETHER AIR POLLUTION POLICY WILL WORK
[Trust in authorities. Scientific credibility]

(10) MY QUALITY OF LIFE

(11) THE LEVEL AIR POLLUTION WHERE LIVE

(12) OTHER INFORMATION I HAVE HEARD ABOUT AIR POLLUTION

(13) EFFECTS ON OTHER PEOPLE

"DID NOT USE THIS FACTOR" CARDS

TAKE ALL "KEY CARDS"(MARK WITH * ON BACK) FROM "DID NOT USE THIS FACTOR" PILE. PROBE THESE CARDS ONLY (IF NONE, GO STRAIGHT TO IV)

I just want to ask you about these cards. Part of the reason that we are doing this is to help us when we put together future studies. ***There are some cards in this study that we think might be important to people but not everyone thinks about them or considers them. Could you say a little about why you didn't find them important?*** [ENSURE FOR TAPE IT IS CLEAR WHICH CARD/S IS BEING DISCUSSED]

Specific probes for "DID NOT USE THIS FACTOR" cards:

General probes (USE AS APPROPRIATE FOR EACH CARD. ENSURE IT IS CLEAR WHICH CARD IS BEING DISCUSSED.)*:*
What do you mean by that? Can you say a little about why it is not an issue for you? Why wasn't this important.

(1) * MY BUDGET (money I have available to me) (*Specific probe:* Where was money coming from then?)
(2) *MY INCREASED ABILITY TO SURVIVE EACH YEAR
(3) * MY HEALTH AND GENES
(4) * NUMBER OF MONTHS
(5) * PAYING FOR THE REST OF MY LIFE

IV EXPLAINING A GAIN IN LIFE EXPECTANCY

• In this last part I'd like to ask you a few things that might help us with future studies in this area.

• You said you'd pay £X for say a 6 month gain in life expectancy. Do you think that you would have paid the same if we had said that the gain would be somewhere between 1 and 11 months or 5 and 7 months?

IF YES. Why?

IF NO? Why? (*To probe: Is it range/uncertainty, chance of getting less [loss aversion] or both*).

• What about if the gain would be between 0 and 12 months?

IF YES. Why?

IF NO? Why?

• Finally, we're always looking for ways to phrase things more simply or to say things more clearly so that we don't unnecessarily confuse people.

• So you said you'd pay £X for say a 6 month gain in life expectancy. If you were to explain to a friend when you went home what you were going to pay for, how best would you describe it to them?

• Some people have described it as an additional 6 months at the end of their life. Would you agree with that?

IF YES: why (*probes: how they think they get the 6 months i.e. the process*)

IF NO, why?