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Understanding VAS valuations: Qualitative data on the cognitive process

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Abstract

Eliciting people's value is a central pursuit in health economics. We explored approaches to valuing a health state on a visual analog scale (VAS). Additionally, we examined whether dual processing (an interaction between automatic and controlled information processing) occurred during VAS valuation. In the first experiment, respondents were probed for their approach after valuation on a VAS. After inductive generalization, we grouped the approaches: (1) 'Sort-of' (automatic processing), (2) 'Bisection of line first', (3) 'Numerical expression', and (4) 'Dividing into smaller segments'. In the second experiment, a short questionnaire followed the VAS in which these approaches were systematically assessed, as was *awareness* of the approach used, *intention* to re-use the approach the next time (confidence), and *basis* of the approach. Data showed that the 'Sort-of' approach was used most often, followed by the 'Bisection-first' approach. We argue that dual processing occurs during performance on the VAS. Awareness of the approach used was lower when an intuitive approach was used. A reasoned approach had a higher correlation with confidence. Thus, awareness of approach may improve reliability. Reducing the number of health states to be valued concurrently diminishes the complexity of the task; this may enhance the validity of the VAS.

Key words: Dual-processing theory, Task performance and analysis, Health state valuation, Qualitative research

Abbreviations: VAS–visual analog scale

Background

The visual analog scale (VAS) is a widely used valuation technique. Devlin et al. [1] reported an extensive study on the valuation of health states using a VAS. They emphasized the need for research to underpin the cognitive processes underlying the VAS. We have qualitative data that allows us to address this subject. This paper elaborates on the types of approaches to valuing a health state on a VAS. Additionally, we assessed whether the approaches used are in concordance with dual-processing theory, which states that behavior is determined by the interaction between controlled and automatic processing [2].

Devlin et al. raised several questions; here we would like to address their fourth question, "What types of approach to valuing hypothetical health states using a VAS are detectable?" In their study, the approaches were not systematically elicited, therefore their data cannot answer this question fully [1]. Moreover, most approaches mentioned in their study were related to a flawed execution. We believe our data can further elaborate on possible approaches leading to usable valuations. The VAS is a seemingly easy method often used to estimate a person's preference value for health states. Health state valuation involves introspection, evaluation and comparison [3]. After this, the valuation is expressed involving several cognitive processes. The VAS is then, basically, a visuospatial motor task.

Cognitive processes can be carried out at two distinct levels with qualitatively different mechanisms. Dual-processing theory states that thoughts, behaviors and feelings result from the interplay of automatic (and implicit) and controlled (and explicit) processing [4]. Automatic information processing is ubiquitous and the default mode of processing. The controlled information processing requires controlled allocation of processing resources (i.e., controlled attention), and, consequently, takes more time [5]. In the literature there is a large body of research, for example in the field of social psychology and decision making, indicating that dual processing occurs during a large number of cognitive processes [4, 6–8]. However, to the best of our knowledge, no research exists that explores whether dual processing is involved in the VAS valuation task.

We carried out two experiments in which respondents were probed for approaches used in the VAS. Possible approaches were explored in the first experiment and were systematically examined in the second. If dual processing is indeed relevant to the VAS, we should find evidence of an implicit and explicit level of thinking. Furthermore, we assume that an explicit approach is more reliable than an implicit approach [9]. Therefore, we assessed the basis and awareness of an approach as well as the intention to re-use it. The measurement subsequently employed to assess the valuation is very accurate (to the millimeter). However, the VAS instruction gives no such indication of accuracy to the respondent. Therefore, in the second experiment, we also assessed the effect of adjusting the VAS instruction.

Methods

Experiment 1

Procedure

Healthy respondents were recruited using newspaper advertisements. They were paid €22.50 for participation in two interviews. A subset of these respondents participated in this experiment. We used a rheumatoid arthritis health state description according to the EQ-5D system (description = 21321) [10], see Appendix A. The valuation for this health state was assessed with a VAS: a 100 mm horizontal line with the anchors 'death' and 'optimal health'. The 16 respondents were afterwards asked to elaborate on their approach. Qualitative data was taped, and transcribed. Analysis involved initial familiarization with the data through sorting and indexing. Through discussion of emergent approaches during data generation possible approaches were detected. One coder coded all comments.

Results

Seven females (mean age = 38) and nine males (mean age = 37) participated. They were educated to at least high school standard. Qualitative data showed that the majority of the respondents were incapable of specifying why the mark was placed at that precise point, other than that it felt right (57% of all approaches reported, 'Sort-of'-approach), e.g. "So I put it nearer death, but not too much. It feels like the right spot." and "I came to the decision because if you have some problems with walking, that is not too bad, ... no problems washing and getting dressed, that is very nice. You are not capable of performing your daily activities, which is very annoying. Then you are bored out of your mind and cannot go anywhere ... it was more roughly done, a bit of feeling and moving."

Many respondents started the task by deciding whether the health state was nearer to death or optimal health by bisecting the line (29% of approaches, 'Bisection of line first'-approach), e.g. "Well, I go directly to the middle of the line and then I move to the right because one can get accustomed to everything, including pain."

Few respondents gave a numerical expression before placement (8% of approaches, 'Numerical expression preceding placement'-approach), e.g. "One provides a sort of value to it, and say, perfect health is a ten, death is zero. Then you provide a value to this health state. It is not death and it is not optimal health. Let's say perfect health is ten and death is zero. ... So ... that would make the quality of such a health state; ... if you translated it to the quality of life in that case ... it would be ... I'd give it a three on a scale of ought to ten. And that is why I put the mark at that spot."

In only 3% of the approaches was the VAS divided into smaller segments ('Small segments'-

approach) e.g. "And that is how I end up at about three-quarters."

We grouped approaches into four categories through inductive generalization: (1) Sort-of, (2) Bisection of the line first, (3) Numerical expression preceding placement, and (4) Dividing the line into smaller segments. Most respondents used more than one approach simultaneously; mostly, the 'sort-of'-approach was applied in combination with another approach. We labeled the 'sort-of'-approach as an implicit approach for it appeared based at an automatic level of thinking. Whereas the other approaches were labeled as explicit approaches for they appeared based at a controlled level of thinking.

Methods

Experiment 2

Procedure

Fifty-eight healthy medical students attending a course were paid €5 for filling out a questionnaire, part of which related to this experiment. Respondents valued the rheumatoid arthritis health state of experiment 1 by using one of two VAS instructions to which they were randomly assigned (Appendix A). Instruction 2 included instruction 1, plus a statement that the number of millimeters from the anchors would be measured to assess the valuation. Possible approaches deduced from experiment 1 were 'Sort-of', 'Bisection first', 'Numerical expression', and 'Smaller segments'. Experiment 1 showed that approaches do not have to be mutually exclusive, hence respondents were asked to indicate on a five-point answering scale the concurrence with their approach ("Does not concur with my approach – Concurs fully with my approach"), separately, for each category. Then the following three questions were answered on a five-point scale:

- (Awareness) "To what extent are you aware of the approach you used to perform this task?" "I am not aware of using an approach – I am aware of using an approach"
- (Basis of approach) "You can perform this task more on the basis of intuition or more on the basis of reasoning. Where do you place your approach?" "Intuitive – Reasoned"
- (Confidence) "Would you probably use the same technique the next time?" "Unlikely to use the same approach – Likely to use the same approach."

A last item inquired whether respondents used an approach not mentioned in the questionnaire. A *t*-test was performed to assess the effect of instruction on questionnaire items. For all respondents, average score per item was assessed, and the (Pearson) correlations between the questionnaire items were assessed.

Results

Twenty-eight respondents were assigned to Instruction 1 (19 females, 9 males, mean age = 21), 30 respondents to Instruction 2 (24 females, 6 males, mean age = 20). No significant effect was seen for Instruction, either for values or questionnaire items. Therefore, we will discuss the results for both instructions.

Respondents most often used the 'Sort-of'-approach (mean score = 3.45, s = 1.23), followed by the 'Bisection first'-approach (mean = 2.97, s = 1.52), the 'Numerical expression'-approach (mean = 2.24, s = 1.41), and the 'Small segments'-approach (mean = 2.19, s = 1.41). Significant negative correlations were observed between the 'Sort-of' and 'Bisection first'-approaches ($r = -0.27$, $p < 0.05$), and the 'Sort-of' and 'Small segments'-approaches ($r = -0.40$, $p < 0.01$). Between the 'Bisection first' and 'Small segments'-approaches, no significant correlation existed ($r = 0.18$). The 'Numerical'-approach was not significantly related to another approach.

Most respondents reported the intention to use the same approach the next time they would perform a VAS (mean = 4.28, s = 0.81). Slightly more respondents were aware of their approach (mean = 3.33, s = 1.03) than unaware. A reasoned approach was used somewhat more frequently (mean = 3.55, s = 1.47) than an intuitive approach.

Table 1 shows that when a 'Sort-of'-approach was used the valuation was more often intuitive, whereas if respondents used a 'Small segments'-approach, the valuation was more often reasoned. If respondents were more aware of their approach,

Table 1. Correlations between the questionnaire items for all respondents

	Awareness (unaware–aware)	Basis (intuitive–reasoned)	Confidence (intention to re-use approach)
Awareness	1.00		
Basis	0.59**	1.00	
Confidence	0.29*	0.21	1.00
Sort-of	−0.38**	−0.62**	−0.14
Bisection first	0.28*	0.18	−0.08
Small segments	0.27*	0.46**	0.08
Numerical	0.01	0.12	−0.03

*$p < 0.05$ (2-tailed); **$p < 0.01$ (2-tailed).

they used a reasoned approach more frequently than an intuitive approach. Awareness also correlated with the intention to use the same approach the next time (Confidence). Confidence appeared not to be directly related to a specific approach. Merely one respondent reported an approach not described in the questionnaire (first she placed the mark, consequently she assessed whether the health state fitted the position; if it did not, the process was repeated).

Discussion

This study tried to provide a better understanding of cognitive processes underlying the VAS. Our experiments showed four not mutually exclusive approaches to valuing a health state by using a VAS. These approaches were, in order of the respondents' preferences, Sort-of, Bisection of line first, Numerical expression, and Division into small segments. The Numerical and Small segments approaches were used less frequently. This coincides with the (visual) concept of the VAS; otherwise a rating scale should be preferred. Respondents appeared reluctant to numerically express their valuation. Adjusting the task instruction by indicating the way responses were to be used did not encourage respondents to use a more explicit approach. The effect of interest was small to medium; consequently, the power was low (0.06) to medium (0.41).

We found evidence of both automatic and controlled information processing during the VAS within subjects. The combination of an implicit and automatic approach ('Sort-of') and an explicit and controlled approach (other reported approaches in this study) was present in most respondents' answers. This underpins the occurrence of dual processing during valuation of a health state using the VAS. However, to confirm that dual processing occurs during the VAS one should focus on the time aspect of the task performance in relation to the approach used. Controlled information processing requires more time than automatic information processing and, as a consequence, an explicit and reflective approach requires more time than an automatic approach [5]. Our study did not include reaction time as a variable, therefore, it does not provide conclusive evidence. It would be interesting to involve this variable, as well as to explore possible approaches with respect to other health status measurement techniques, e.g. standard gamble and time trade-off.

Awareness correlated negatively with the implicit approach. Respondents who were more aware, indicated a stronger willingness to use the same approach the next time. The questionnaire may have, in the less aware respondents, induced the idea that next time they should give the task more thought. (We cannot assess this, because we did not ask which approach they would use the next time.)

In contrast to the study by Devlin et al. we used a horizontal VAS and asked subjects to value a health state in isolation. Devlin et al. observed that the valuation task used in their study as well as in the EQ-5D, is too complex. Consequently, the cognitive burden was sizable [1]. Most approaches reported in their study led to unusable or problematic valuations. Our findings do not show these undesired approaches, either because of our systematic assessment of approaches in comparison to their by-product assessment, or because the VAS used in this paper was less involved (the health state was valued in isolation). Bleichrodt & Johannesson also argued against valuing several health states simultaneously [11]. In lessening the number of health states that are valued concurrently, the complexity of the task is diminished, and possibly the validity of the VAS is enhanced. A disadvantage, however, is that rank ordering of many health states would no longer be possible. Thus, a trade-off has to be made. Rank ordering the health states beforehand as a separate task can further refine the validity of the valuation process.

Both in our study and in the study by Devlin et al. some respondents used a 'numerical' approach. The other approaches we reported were not found in their study. However, detecting these approaches required cognitive interviewing which Devlin et al. did not aim for. Other approaches in their study, leading to usable valuations, are specific for the vertical VAS, and, therefore, were not observed in our study.

Our qualitative analysis revealed several possible approaches that were coded by only one coder. Furthermore, the process of valuing appears to be partly automatic, therefore, it is possible that more approaches exist than are reported here. Although an argument in favor of reliability is that, in the second experiment, only one respondent indicated using an approach that was not reported in the questionnaire.

We present evidence of dual processing during health state valuation using the VAS. Controlled processing, for example, being aware of an approach, may enhance reliability of the VAS since the use of a similar strategy on two occasions stands a higher chance of producing the same result. Additionally, awareness is related to explicit approaches (such as bisecting the line first, or dividing it into smaller segments). These findings are an argument – for the sake of reliability – in favor of instructing respondents beforehand, in order to determine their approach.

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Appendix A

Instruction 1

"How do you value the following rheumatoid arthritis health state?"

Some problems walking about
No problems washing or dressing
Unable to perform usual activities (work, family, leisure)
Moderate pain or discomfort
Not anxious or depressed.

We would like you to indicate on this scale how good or bad you find this health state. Please do this by placing a mark on this line. The closer to the left you place the mark, the more you value the health state in the same way that you would value death. The closer to the right you place the mark, the more you value the health state in the same way that you would value optimal health.

Instruction 2

Instruction 1 and "Afterwards we will assess your valuation for this health state by measuring the number of millimeters, in which death is equivalent to 0 mm and optimal health is equivalent to 100 mm."

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