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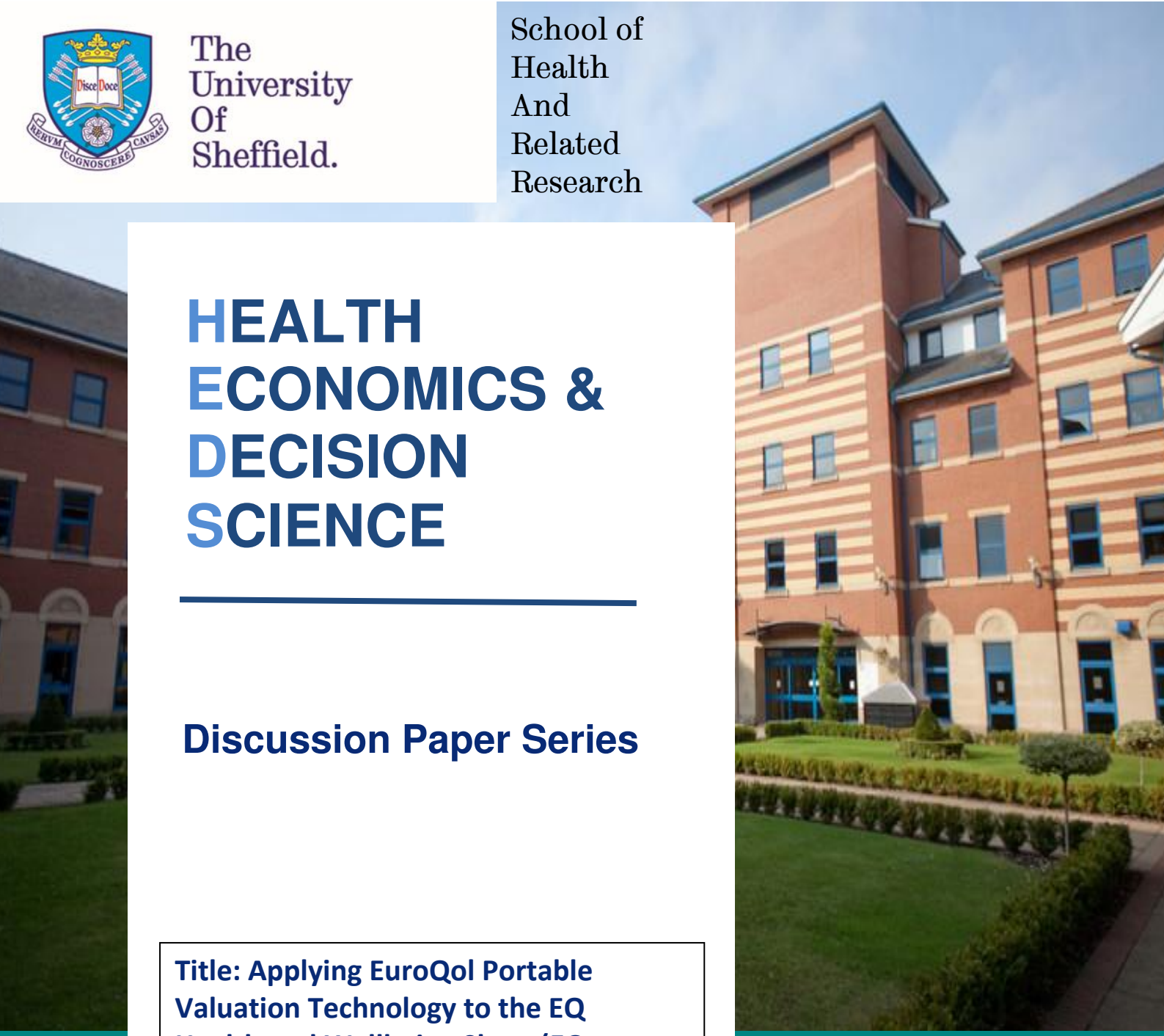

HEALTH ECONOMICS & DECISION SCIENCE

Discussion Paper Series

Title: Applying EuroQol Portable Valuation Technology to the EQ Health and Wellbeing Short (EQ-HWB-S): a pilot study

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Applying EuroQol Portable Valuation Technology to the EQ Health and Wellbeing Short (EQ-HWB-S): a pilot study

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Conflicts of Interest: John Brazier, Tessa Peasgood and Clara Mukuria are members of the EuroQol Group Association

Keywords: EQ-HWB-S, utility, valuation, preference-based measures, TTO, DCE, EQ-VT

OBJECTIVES: The aim was to assess whether existing valuation methods were suitable for the nine item EQ Health and Wellbeing Short™ (EQ-HWB-S).

METHODS: EuroQol Portable Valuation Technology (EQ-PVT) which uses composite time trade-off (cTTO) and discrete choice experiments (DCE) was modified for the EQ-HWB-S™. Volunteer non-academic University of Sheffield staff were recruited. A mixed methods approach involving qualitative interviews and assessment of quantitative data was used to assess the applicability and feasibility of EQ-PVT to EQ-HWB-S. Participants valued six states using cTTO (three EQ-HWB-S and three EQ-5D-5L™) and four EQ-HWB-S states using DCE.

RESULTS: Nineteen participants with mean (SD) age 48.2 (13.0) were interviewed. Mean TTO values were ordered as expected with higher mean values for the mild EQ-HWB state compared to the moderate and severe states. Most participants found it fairly or very easy to understand cTTO questions for both EQ-HWB-S 94.7% (18/19) and EQ-5D 89.5% (17/19). Pain, activities and depression were considered key drivers for respondents' choices. Additional information in the EQ-HWB-S was useful in helping to imagine what life would be like but it could also be overwhelming and make the tasks difficult. 'Coping' was a problematic item as it was either used as an overall assessment of the state or ignored in favour of participants' perceived ability to cope with the state. 'Coping' was replaced with 'control' which did not have the same problems. Participants generally preferred DCE to TTO. DCE presentations with overlap but with simple formatting were preferred.

CONCLUSIONS: A modified standardised valuation has been successfully applied to health and wellbeing states defined by the EQ-HWB-S. A full feasibility study is now required.

Highlights

- A new generic measure of health and wellbeing, the EQ-HWB, has been developed for use in economic evaluation but it has not been valued.
- An existing valuation protocol, the EuroQol Valuation Technology (EQ-VT) was adapted and tested for the new measure. Following some modifications, participants were able to value the new measure although more time may be required and future studies should take that into account.

BACKGROUND

The Extending the QALY project has developed a new generic measure based on the views of users and beneficiaries of these services including informal carers that is broader than health, the EQ Health and Wellbeing (EQ-HWB™)[1]. It is designed so that it can be used in economic evaluation across health, social care and public health to estimate quality adjusted life years including in the assessment of the impact of caring or interventions for carers with regards to informal carers. This would enable the assessment of outcomes within and across different sectors e.g. health and social care as well as across populations that are impacted e.g. patients and their informal carers. The EQ-HWB has a long form measure with 25 items and a shorter version, the EQ-HWB Short (EQ-HWB-S) with nine items, the latter being developed for valuation purposes to generate utility values[1]. The measures cover items related to seven dimensions: activity, relationships, cognition, self-identify, autonomy, feelings and physical sensations. These versions are experimental versions with further on-going[2] work.

There are different valuation methods that could be used to elicit utility values including time trade-off (TTO), standard gamble (SG) and discrete choice experiments (DCE with or without duration). These common valuation methods have successfully been applied to different preference-based measures of health, but there are questions about whether they can be applied to a measure of health and wellbeing. Valuation tasks such as TTO and SG are cognitively demanding and the common use of general population samples means that the states they value are often hypothetical in nature[3]. Pairwise choices as implemented through DCE may be simpler to understand for participants, but the amount of information can make it difficult for participants to make a choice. For example, if a state has five dimensions then a pairwise choice would involve considering 10 pieces of information. Studies have tested overlap in some of the choices across pairs e.g. only varying three out of five dimensions with the other two being the same across the pair and/or highlighting where differences occur[4–6] in order to minimise the cognitive burden. For example, this is the approach applied to EORTC-QLU-C10D (European Organisation for Research and Treatment of Cancer Quality of Life Utility Measure - Core 10 dimensions) valuation studies[7]. The EQ-HWB-S was limited to 10 or less dimensions in the item selection consultation stage as it was not considered likely that the 25 item questionnaire could be valued using standard methods[1].

The resultant EQ-HWB-S classifier has nine items therefore standard approaches to valuation could be applied. Given the success with the use of the standard EQ-Valuation Technology (EQ-VT) v2 protocol for valuing the EQ-5D-5L™ [8], it was decided, at least in the first instance, to value the new measure using this approach. This study presents a pilot that was designed to assess the feasibility and practicality of applying EQ-VT to value the EQ-HWB-S.

METHODS

The pilot study employed a mixed-methods approach which assessed how well the valuation methods could be applied to the EQ-HWB-S relative to EQ-5D-5L as EQ-VT has been successfully applied to the latter measure.

Measures

EQ-5D-5L is a preference-based measure with five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) with five severity levels for each question (none to extreme/unable)[9]. EQ-5D-5L has been valued successfully in several countries using EQ-VT v2[8]. EQ-HWB-S is a new preference-based measure with nine items (activities, mobility, pain, fatigue, cognition, loneliness, sad/depression, anxiety, coping/control) with five severity levels for each questions (see Table 1)[1].

Valuation Method

EQ-VT relies on composite TTO (cTTO) where states better than dead are valued using a choice of living for a shorter period in full health (n<10 years) versus living in an impaired state for a longer period (n=10 years), with the time in full health varied until participants are indifferent. For states worse than dead, the choice is living in full health for a shorter period (n<10) versus living for 10 years in full health followed by 10 years in the impaired state. EQ-VT protocol also includes DCE without duration. Preference elicitation is administered in a computer assisted personal interview (CAPI) via a bespoke survey[8].

In this study, the CAPI interview was based on a modified version of the EQ Portable Valuation Technology (EQ-PVT) which was developed in PowerPoint for EQ-5D-5L that has been applied successfully[10]. EQ-PVT is the same as EQ-VT apart from delivery via PowerPoint rather than a dedicated survey that is housed centrally by the EuroQol Group. EQ-PVT allowed modifications to be made via PowerPoint. Modifications included adding the EQ-HWB-S states, changing the accompanying script to reflect the new measure, and changing the upper anchor from 'full health' to 'full health and quality of life' to reflect the broader EQ-HWB-S. To minimise confusion, this anchor was retained across both EQ-5D-5L and EQ-HWB-S. In the EQ-VT protocol[8], participants are asked to read out each state they value to ensure engagement; to allow for accessibility (e.g. for those with sight/reading difficulties). We modified this to allow participants to ask the interviewer to read out the state if that was preferred.

Valuation states

The EQ-VT protocol involves practice states, namely, three wheelchair states (wheelchair (WC), better than WC and worse than WC) followed by three EQ-5D-5L practice states. For this study, the WC states

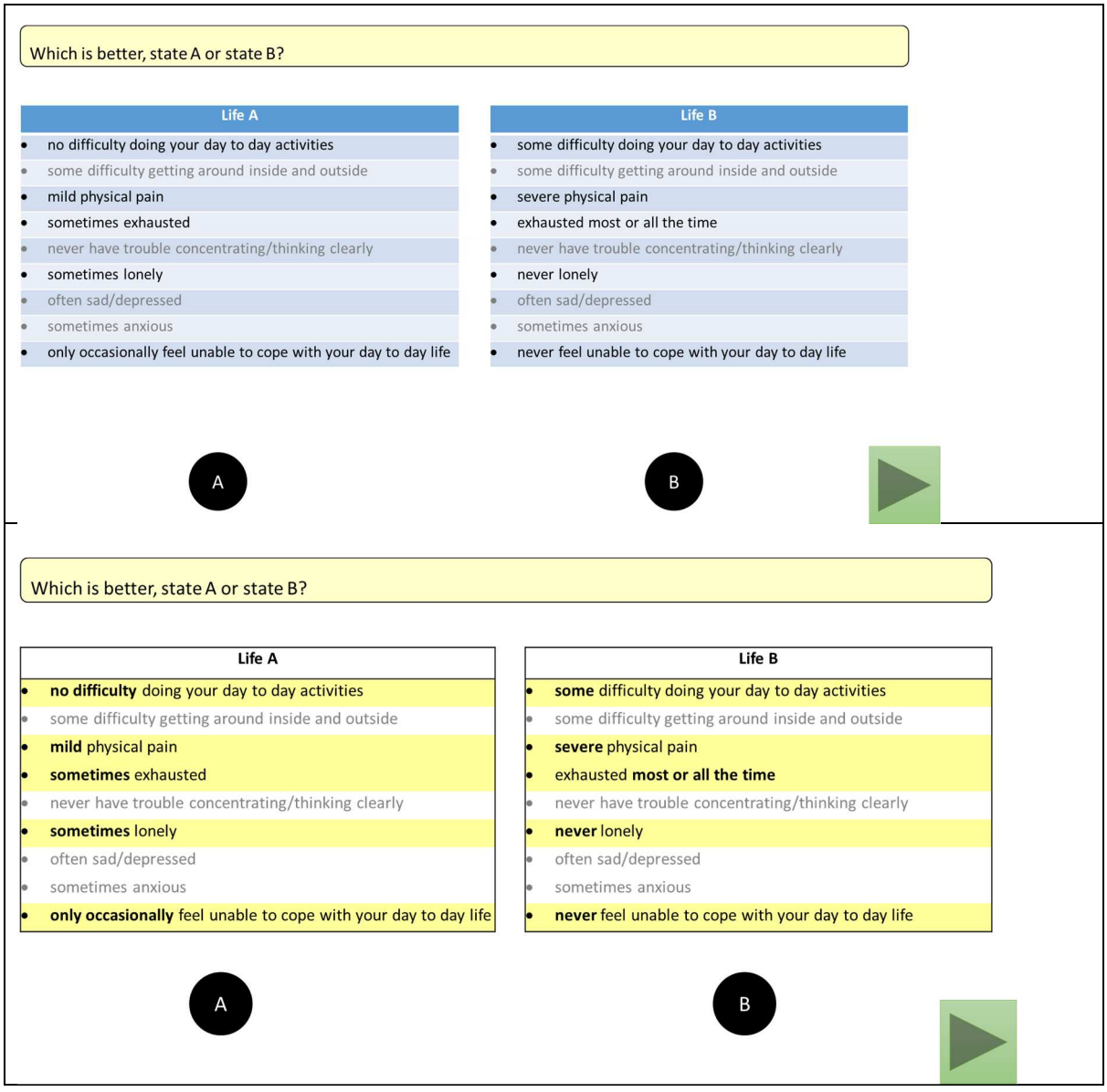
were used in the practice while the EQ-5D-5L practice states were treated as real states (Appendix Table 1). EQ-HWB-S states for cTTO were selected to match the selection of the EQ-5D-5L practice states i.e. one mild, one implausible sounding and one severe (Appendix Table 1). The EQ-HWB-S states were presented in a similar way to EQ-5D-5L as a stem of the actual questions that were used rather than the who statement (Table 1).

Table 1: EQ-HWB Questions and classifier, including modifications

EQ-HWB Questions	**Classifier vs1**	Classifier vs1.2	Classifier vs 2
How difficult was it for you to do day to day activities (e.g. working, shopping, housework)?	a lot of difficulty doing day to day activities	a lot of difficulty doing day to day activities	a lot of difficulty doing day to day activities
How difficult was it for you to get around inside and outside (using any aids you usually use e.g. walking stick, frame or wheelchair)?	a lot of difficulty getting around inside and outside	a lot of difficulty getting around inside and outside	a lot of difficulty getting around inside and outside
I had no/mild… physical pain	moderate physical pain	moderate physical pain	moderate physical pain
I felt exhausted	exhausted only occasionally	only occasionally exhausted	only occasionally exhausted
I felt lonely	trouble concentrating/thinking clearly some of the time	sometimes have trouble concentrating/thinking clearly	sometimes have trouble concentrating/thinking clearly
I had trouble concentrating/thinking clearly	lonely only occasionally	only occasionally lonely	only occasionally lonely
I felt sad/depressed	sad/depressed often	often sad/depressed	often sad/depressed
I felt anxious	anxious only occasionally	only occasionally anxious	only occasionally anxious
I felt unable to cope with my day to day life	unable to cope with your day to day life none of the time	never feel unable to cope with your day to day life	
I felt I had no control over my day to day life e.g. having the choice to do things or have things done for you as you like and when you want			never feel you have no control over your day to day life

For the DCE choice sets, four pairwise choices were randomly chosen from a pool of pairwise choices based on a D efficient design with no overlap (see Appendix Table 2). A hypothetical pair where there was overlap in 4/9 of the dimensions was also tested in terms of presentation including variations based on colours, shading/highlighting, and presenting text in bold (Figure 1).

Figure 1: Alternative DCE formatting



Participants

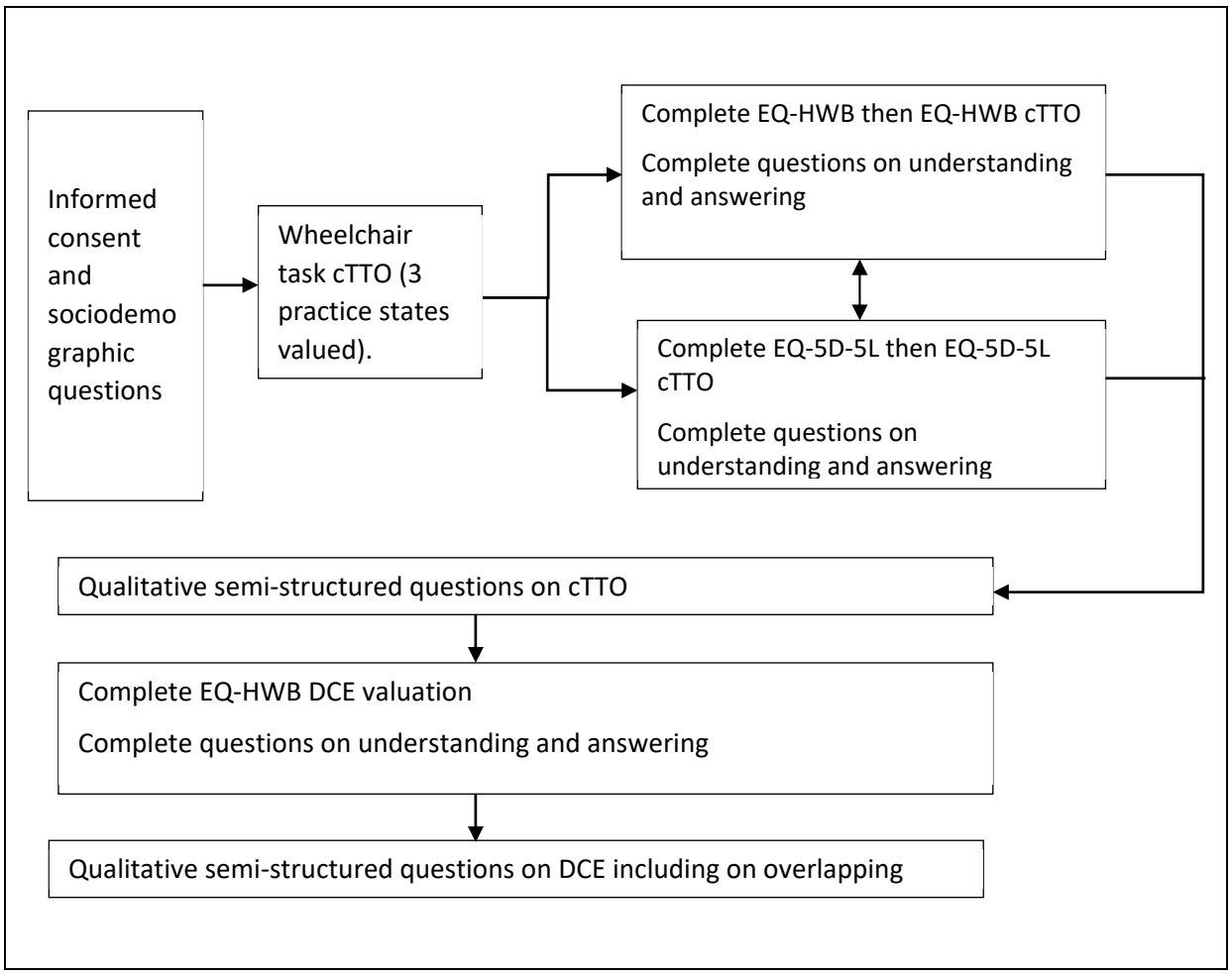
Participants were recruited by email from a volunteers list at the University of Sheffield which is open to University of Sheffield employees, their family members and retirees (academics and teaching staff were excluded). A snowballing technique was also used to target those over 65; early interview participants were asked to pass an advert to friends or family who were over 65. Adults (18 years and

over) with a broad mix of age and gender were targeted. An initial sample size of 15 was targeted and this was increased to 20 due to modifications to the EQ-HWB-S.

Interview procedure

Figure 2 shows the flowchart for the interviews. All participants completed socio-demographic questions, the two measures, three WC practice questions followed by six states, three EQ-5D-5L and three EQ-HWB-S with the order of the measure randomised. Paper-based questionnaires were used for sociodemographic, measures and questions on how participants found completing the valuation survey.

Figure 2: Flowchart of Stage 1 interviews



Interviews were undertaken by TP and CM. Each interviewer completed two test interviews with non-academic colleagues prior to the actual pilot to check EQ-PVT and the modified script. A topic guide was used to support the interview process (see Appendix 3). Participants were asked how they made decisions following cTTO, whether there were dimensions they always/never used to decide and why; and whether there were states that were easier or more difficult to value and why. They were also asked which of the two measures they found easier to use when making decisions. For the DCE,

participants were asked similar questions to those following the cTTO, e.g. what influenced their decisions. In addition, they were asked whether they had a preference for cTTO or DCE and why and which presentation of DCE they preferred and why. All interviews were recorded using encrypted devices.

All participants provided informed consent. Ethical approval for the study was obtained from the School of Health and Related Research Ethics Committee at the University of Sheffield.

Analysis

Recordings were used to summarise the key points from the interviews based on the research questions with relevant quotes to support the findings. Each interviewer made notes related to their interviews and the findings were then discussed and emerging themes agreed. Considerations of whether cTTO could be successfully applied to the EQ-HWB-S relied on assessment of:

- distribution of values within and across mild, implausible and severe states;
- which dimensions drove decisions;
- responses to the questions about ease of understanding and ease of answering the questions; and
- interviewer's assessment of engagement.
- The number of participants who found it difficult to understand and answer cTTO and DCE was also assessed.

The interviews were used to ensure that the presentation of these states made sense to participants with modifications to reflect any required changes. This included modifications based on readability and performance of the items. Modifications were made as the interviews progressed to reflect any changes that were deemed necessary for EQ-HWB-S valuation using EQ-PVT.

RESULTS

Participants

Nineteen participants of mean (SD) age 48.2 (13.0) [range: 26-74] were interviewed. The majority were female (63%), white British (84%) and had a degree or professional equivalent (74%). Almost half (47%) had a long-standing physical or mental health problem but overall, 79% said they had good to excellent health. All participants completed all the cTTO questions but only 17 did all the DCE questions; one participant did two as they struggled to make a choice, and another did one because of time constraints.

Results

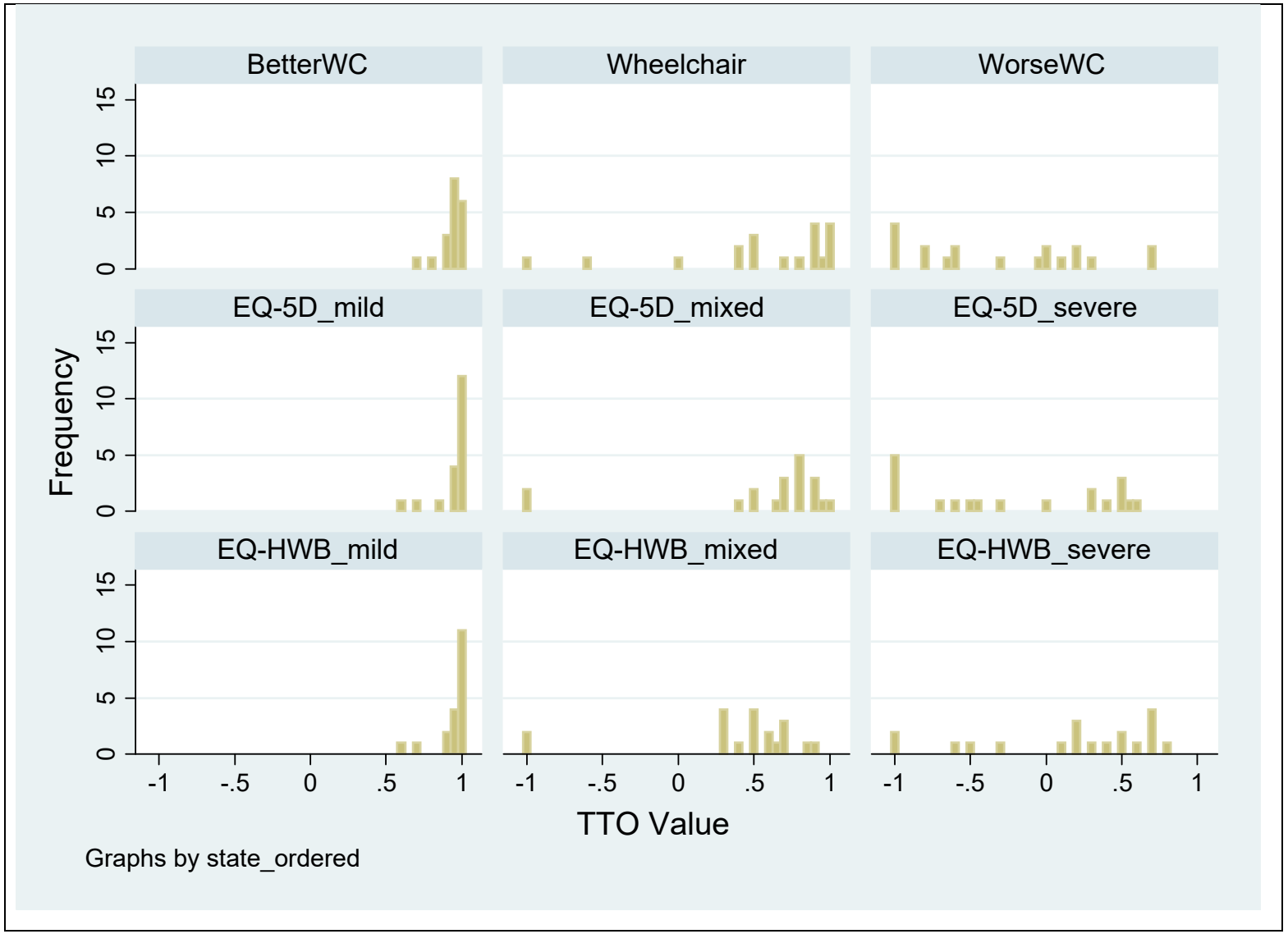
TTO values

Mean TTO values were in the expected direction with mild states having higher values compared to mixed or severe states for both EQ-5D-5L and EQ-HWB (Table 2, Figure 3). As would be expected, there was more variation in values for the mixed or severe states compared to the mild states for both measures. This selection of EQ-5D-5L states were valued as worse than dead 12 times and seven times for the selected EQ-HWB-S states.

Table 2 TTO values by state (sample n=19)

State	Mean	Standard deviation	Minimum	Maximum
Better than WC	0.937	0.08	0.7	1
Wheelchair (WC)	0.566	0.56	-1	1
Worse than WC	-0.295	0.58	-1	0.7
EQ-5D_mild	0.945	0.11	0.6	1
EQ-5D_mixed	0.568	0.57	-1	1
EQ-5D_severe	-0.205	0.64	-1	0.6
EQ-HWB_mild	0.942	0.11	0.6	1
EQ-HWB_mixed	0.384	0.52	-1	0.9
EQ-HWB_severe	0.168	0.58	-1	0.8

Figure 3 TTO values by state



Assessing feasibility of cTTO with a longer measure

Participants were equally able to work through the cTTO exercise with both EQ-5D-5L and EQ-HWB-S. Some changes were made to the wording of the classifier after the first three interviews (plus four pre-pilot interviews) including using 'never' instead of 'none of the time' and 'sometimes' instead of 'some of the time' as well as changing the position of the severity level i.e. appearing first rather than last (see Table 1). These changes were driven by the difficulty (and awkwardness) found by the early respondents reading the initial states, and the fact that some respondents automatically switched to the more natural linguistic framing/terms. An uncompleted EQ-HWB-S was also made available for the respondent to look at during the interview in response to respondents' suggestions for making the task easier.

Assessing feasibility of cTTO with EQ-HWB-S states

Most participants found it fairly or very easy to understand cTTO questions for both EQ-HWB-S (94.7%, 18/19) and EQ-5D (89.5%, 17/19). There were 9/19 participants who found it very (n=2) or quite difficult to answer the cTTO EQ-HWB-S questions while 10/19 participants found it quite difficult (none said very) to answer the EQ-5D-5L cTTO questions.

There were mixed views with regards to whether EQ-5D-5L or EQ-HWB-S states were preferred for completion of cTTO. Some reported they did not really notice the difference (e.g. 1001 Male (M)), others felt the additional information in the EQ-HWB made the task a bit harder because there was '*more to balance out and weigh up*" (1004 M), with tasks using the EQ-5D-5L having "*less to keep in your head*" (1002 Female (F)), and being "*easier to make a decision*" (1007 M). However, some respondents found the additional information useful:

> "…*You've got more idea of quality of life even though it's still difficult to decide - it gives you more information to make an informed choice – it is still difficult to choose*" (1005 F)
>
> "*It gave me a better impression of what that life would be… gave a better mental image*" (1018 F)

In terms of what dimensions affected participants decisions, one of the key dimensions or '*triggers*' (1007 M) was pain which was related to consequences e.g. on activity, thinking clearly, and coping.

> *"In my head if you are in severe physical pain you are not just going to be able to carry out your day to day activities …*" (1002 F)

When discussing the EQ-5D-5L pain/discomfort item the focus of the discussion was on 'pain' and no respondents raised the issue of 'discomfort'.

The other dimension that was frequently raised as important was activity (including self-care and usual activities) (e.g. "*my particular driver*" (1008 M)). This was seen as related to other dimensions such as mobility, exhaustion, and even mental health.

> *"...I can't imagine this condition for myself because if I were unable to wash or dress or engage in my usual activities I think it would affect my mood, it would be difficult to be positive…"* (1011 F)

In the context of self-care, respondents raised disliking the idea of others having to look after them.

> "*I don't want anyone to look after me… It's all the toileting business that I don't' like*" (1001 M)

Feeling sad/depressed or anxious/depressed were also considered important for participants.

> "*I don't see how you could enjoy life when you're anxious most of the time..."* (1013 F)

There were mixed views on the importance of dimensions related to loneliness, concentrating/thinking clearly, exhaustion and mobility. For example:

> *"I don't care very much about this … 'often' lonely - I find it not that bad - I find it creative in a way…."* (1014 F)

> *"…I wouldn't want 10 years of severe pain, exhaustion and loneliness…"* (1011 F)

> "*They have all got value – but I'd put more onto the first three* [activities, mobility, pain] *than the others – you could find ways of dealing with exhaustion – relax, do things differently*." (1008 M)

Some participants found it more difficult to imagine having physical problems but not experiencing low mood. However, others noted that what mattered was the mental state and could separate the two:

> *"…What I was thinking about was first how much pain was this person going to be in…but I know there are ways to cope with it, so that was where the mental state came in. … So I can only assume that the people that had good mental state and were not depressed lonely had good coping mechanisms…"* (1010 F)

The item on coping was problematic as participants either considered it as a summary of the state:

> *"That's what decides it… if you feel able to cope it doesn't matter to me what the issues* [other dimensions] *are"* (1009 F)

"*Someone is in physical pain and is exhausted and is depressed often – that's quite debilitating but that last statement almost seems to change that entire description because it says you're actually coping with living like that – you have found a place where you are OK with it*." (1004 F)

Or they considered whether they personally could cope with aspects of the state to make a decision, regardless of the level of coping specified within the state:

"*I think I could cope with those scenarios*" (1005 F)

Coping was therefore used to make the decision regardless of the other dimensions *or* the level of coping in the state was ignored as participants considered their own coping abilities. Some respondents also felt that 'coping' was hard to interpret when levels were contrary to the sad/depressed item; one noted of such a state that it "*seems a bit contrary at times – sad/depressed often but unable to cope with your day to day life only occasionally*" (1003 M). Others also noted potential inconsistency relating to coping and anxiety, and coping and exhaustion, and coping and activities.

"… Why would you feel unable to cope with your day to day life if you have no difficulties with your day to day activities…" (1011 F).

Coping was replaced with control for an additional four interviews, and this did not raise similar problems. Two participants understood that control was about having choice and not having "*a health problem that limits the things you do like working or leisure*" (1018 F). However, the other two were not clear what control was without looking at the explanation on the blank questionnaire.

Some of the participants noted that the response level of 'only occasionally' could reflect normal life. One participant noted that dimensions with 'only occasionally' was like the *"average person"* (1003 M), another said it was hard to distinguish between never and only occasionally (1007 M). Similar comments were made in relation to the response level 'slight' for EQ-5D-5L.

Assessing feasibility of DCE with the EQ-HWB-S

Although all the participants found it very or fairly easy to understand the DCE questions, most of them (12/18) found it very (n=1) or quite difficult to answer the DCE questions. One participant was unable to complete the DCE as she found it impossible to decide. Some respondents raised the issue of inconsistencies of the states – which may have been because DCE increased the focus on the state when they made decisions.

On balance, respondents preferred choices which had overlapping levels in some domains but only subtle layout changes – and flagged the need to carefully explain any differences in colour of text. The bolding of levels was less popular – some felt it was confusing and others felt it would lead to them

ignoring the actual item and just focusing on the differences between levels *"…I think it might mean that people focus on 'no difficult', 'mild', 'sometimes' rather than thinking – what are the implications of not being able to do your activities?*" (1011 F) . Participants also noted that they would disregard or pay less attention to options that were the same across the two states with one participant noting that this would potentially be problematic:

> *"…*[DCE is] *easier as there's less information now you are just disregarding those but at the same time I think its resulting in a less informed decision because if you are ignoring those you are not really…well they are the same so when you are comparing you don't care about them but it might also mean that you are totally disregarding them…for example if here it said very severe pain in both you forget that it's mixed with that* [the part of the state that varies]*"* (1014 F)

When asked how many more states they could value, most participants said no more than a few more – particularly for the DCE. They were concerned about getting muddled and confused if too many were done.

TTO vs DCE

Some participants found it easier to do cTTO "*It's an easier thing to do because you are comparing against full health which at least for me is like me… it did feel easier" (1006 M)* compared to DCE where they were: "*holding those two states in my head*" (1006 M). Others found it easier to do the DCE as "… *It's hard to quantify things on such a minute level to say exactly how many years you'd give up for various things*…" (1010 F) or because with DCE "*I feel like I am more informed. Whereas with the other one I felt like I was taking guesses"* (1014 F).

Some participants found TTO emotionally draining and noted it was more "*dramatic*" (1007 M) because of giving up years of life. Participants disagreed as to which task required the greatest level of reflection and thought.

DISCUSSION AND CONCLUSION

This small sample was able to complete cTTO and DCE using EQ-HWB-S and there are no indications that EQ-PVT would not work equally for this measure as it does for the EQ-5D-5L. Participants were able to understand and answer the cTTO questions with EQ-HWB-S descriptors. Mean EQ-HWB-S TTO values in the three states that were included were as expected with higher values for mild states and lower values for the two more severe states. Larger samples using a standard approach are needed to confirm this finding.

As with the EQ-5D-5L states, pain (though without discomfort), activities, depression, and anxiety (as separate domains) were considered important drivers of decisions for the EQ-HWB-S. Participants had mixed views of the other dimensions (lonely, trouble concentrating/thinking clearly, exhaustion, mobility). Coping was important to participants. However, it was problematic as some participants made their own judgement of whether they could cope or not with the state while ignoring the level of severity in the coping dimension while others ignored the state and focused on the level of severity in this dimension. Coping was therefore replaced with control which did not have a similar impact. Although coping and control are domains of the same overall theme (autonomy, coping and control), and within the larger EQ-HWB 25 measure they have been found to be highly correlated, they are different constructs[11].

Participants were able to value the EQ-HWB-S states but there was evidence that some participants found it more difficult to consider the longer description and therefore more time would be needed to allow them to consider it in detail. Some aspects were also ambiguous when presented in the summarised state which did not contain the examples used to support understanding within the questionnaire. To minimise ambiguity, a blank copy of the EQ-HWB-S was used in the interviews and would be recommended going forward.

There were also questions of whether states were plausible. Some participants questioned some combinations, e.g. doing activities and not being able to get around or being lonely and not depressed because they could not imagine these states as they thought dimensions were related or limitations in one would impact on another dimension; which is not unique to EQ-HWB-S (e.g. Zhihao et al[12]). This is why an implausible sounding state is included in the practice of EQ-VT to encourage participants that those states exist even if they cannot easily imagine a state for themselves[8,13]. This requires careful consideration of the practice states to ensure that participants are prepared in a way that allows them to engage with the states they value. Although participants were able to imagine states, the mix of physical states and mental health or wellbeing states made it more difficult to imagine. For some this was because they made decisions about states based on how they thought they would feel. This was not limited to EQ-HWB-S but the additional dimensions increased the potential for this. The interviewer framing some combinations of problems and limitations as linked to a caring role rather than personal health helped respondents view some states as plausible. In addition to the careful use of the practice states, providing the opportunity for respondents to express concerns about implausibility and discuss the difficult of imagining the state with the interviewer will be helpful in ensuring respondents stay engaged with the tasks.

Finally, participants noted that the decrement of 'only occasionally' across the domains could be considered part of normal life. This may give an indication that five levels are not necessary – however, given the clear ordering of all item response levels identified within previous psychometric analysis [11] this was not judged as adequate evidence to consider combining levels at this stage.

Respondents reinforced the general view that whist DCE is easier to understand than TTO, the act of making a decision between pairs is still challenging and time consuming[13] – particularly with nine dimensions. In the DCE task, most participants preferred options with more overlapping levels across the two states in each pair with slight highlighting to indicate where there were differences. Excessive highlights were seen as problematic as this was additional information that needed to be interpreted. Some of the highlights, such as putting the severity levels in bold, were problematic as participants noted that this increased the chance of ignoring the dimension attached to the severity level. This is in contrast to findings in a large study[6] (n=3,394) on the impact of overlap, use of colour and highlighting levels where the lowest level of dropout and highest level of attribute attendance was observed when there was a combination of overlap, colour and highlight and in a small qualitative study[5] (n=8) where participants preferred highlights because they were easier to read.

Participants responses to the question of valuing additional states suggests that it may not be possible to do 10 TTO and seven DCE tasks as recommended in the EQ-VT protocol. In this study, participants valued six states in addition to the three wheelchair states, and four DCE but most thought they could only have added a few more before they got overly tired and potentially muddled. It may be that the large number of dimensions in the EQ-HWB-S increased the time and effort required. However, it may also be the additional qualitative element that was built into our study that was making the task more tiring and difficult.

This study was a useful starting point to support the feasibility of using a modified EQ-PVT protocol for the new EQ-HWB-S. However, this is based on a small, educated sample. The participants only valued three EQ-HWB-S states in the cTTO whereas the standard EQ-VT protocol includes 10 cTTO EQ-5D-5L states. Furthermore, incorporating the qualitative aspects into the study may have had an impact as it may have made participants focus more on the content of the states than they would under normal valuation conditions. Despite these limitations, the study was useful in identifying important changes that were needed prior to running a larger study which would have been difficult to identify using purely quantitative methods, e.g. the problems associated with the 'coping' item. The next stage of the study will run a feasibility study using a standard approach for both cTTO and DCE with more states per

task and overlap in the DCE. This will provide additional information on the feasibility of using the EQ-VT v2 protocol to value EQ-HWB-S.

REFERENCES

1. Brazier JE, Peasgood T, Mukuria C, et al. Development of a new generic measure of health and wellbeing for estimating Quality Adjusted Life Years: the EQ Health Wellbeing (EQ-HWB). *Value Heal*. (Submitted themed issue).
2. EuroQoL Group. EuroQol is developing a new instrument – the EQ-HWB – EQ-5D. EuroQoL Group. Published 2021. https://euroqol.org/euroqol-is-developing-a-new-instrument-the-eq-hwb-2/
3. Brazier JE, Ratcliffe J, Salomon JA, Tsuchiya A. *Measuring and Valuing Health Benefits for Economic Evaluation*. 2nd ed. Oxford University Press (Great Clarendon Street, Oxford OX2 6DP, United Kingdom); 2017.
4. Mulhern B, Norman R, Shah K, Bansback N, Longworth L, Viney R. How Should Discrete Choice Experiments with Duration Choice Sets Be Presented for the Valuation of Health States? *Med Decis Mak*. 2018;38(3):306-318. doi:10.1177/0272989x17738754
5. Norman R, Viney R, Aaronson NK, et al. Using a discrete choice experiment to value the QLU-C10D: feasibility and sensitivity to presentation format. *Qual Life Res*. 2016;25(3):637-649. doi:10.1007/s11136-015-1115-3 https://eprints.whiterose.ac.uk/90936/
6. Jonker MF, Donkers B, de Bekker-Grob EW, Stolk EA. The Effect of Level Overlap and Color Coding on Attribute Non-attendance in Discrete Choice Experiments. *Value Heal*. 2018;21(7):767-771. doi:10.1016/j.jval.2017.10.002
7. King MT, Viney R, Simon Pickard A, et al. Australian Utility Weights for the EORTC QLU-C10D, a Multi-Attribute Utility Instrument Derived from the Cancer-Specific Quality of Life Questionnaire, EORTC QLQ-C30. *Pharmacoeconomics*. 2017;36(2):225-238. doi:10.1007/s40273-017-0582-5
8. Stolk E, Ludwig K, Rand K, van Hout B, Ramos-Goñi JM. Overview, update, and lessons learned from the International EQ-5D-5L valuation work: version 2 of the EQ-5D-5L valuation protocol. *Value Heal*. 2019;22(1):23-30. https://eprints.whiterose.ac.uk/141263/
9. Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res*. 2011;20(10):1727-1736. doi:10.1007/s11136-011-9903-x
10. Welie AG, Gebretekle GB, Stolk E, et al. Valuing health state: an EQ-5D-5L value set for Ethiopians. *Value Heal Reg issues*. 2020;22:7-14. https://eprints.whiterose.ac.uk/153785/3/Valuing%20health%20state%20%20An%20EQ-5D-5L%20value%20set%20for%20Ethiopians%20submitted%20%281%29.pdf
11. Peasgood T, Mukuria C, Brazier JE, et al. Developing a new generic health and wellbeing measure: psychometric survey results for the EQ Health and Wellbeing (EQ-HWB). *Value Heal*. 2021;(Themed Issue).
12. Yang Z, Feng Z, Busschbach J, Stolk E, Luo N. How Prevalent Are Implausible EQ-5D-5L Health States and How Do They Affect Valuation? A Study Combining Quantitative and Qualitative Evidence. *Value Heal*. 2019;22(7):829-836. doi:10.1016/j.jval.2018.12.008
13. Mulhern B, Bansback N, Brazier J, et al. Preparatory study for the revaluation of the EQ-5D tariff: Methodology report. *Health Technol Assess (Rockv)*. 2014;18(12):1-191. doi:10.3310/hta18120

Appendix Table 1: cTTO states

	Mild	**Mixed/unlikely**	**Severe**
EQ-5D-5L	*slight problems in walking about *no problems washing or dressing myself *no problems doing my usual activities *slight pain or discomfort *not anxious or depressed	*no problems in walking about *unable to wash or dress myself *severe problems doing my usual activities *no pain or discomfort *not anxious or depressed	*moderate problems in walking about *unable to wash or dress myself *unable to do my usual activities *extreme pain or discomfort *severely anxious or depressed
EQ-HWB-S	*slight difficulty doing day to day activities *slight difficulty getting around inside and outside *slight physical pain *only occasionally exhausted *only occasionally have trouble concentrating/thinking clearly *only occasionally lonely *never sad/depressed *only occasionally anxious *only occasionally feel unable to cope with your day to day life	*no difficulty doing day to day activities *some difficulty getting around inside and outside *severe physical pain *exhausted most or all the time *never have trouble concentrating/thinking clearly *sometimes lonely *often sad/depressed *sometimes anxious *only occasionally feel unable to cope with your day to day life	*unable to do day to day activities *some difficulty getting around inside and outside *severe physical pain *often exhausted *often have trouble concentrating/thinking clearly *often lonely *sometimes sad/depressed *often anxious *often feel unable to cope with your day to day life

Appendix Table 2: DCE questions

A	B
*a lot of difficulty doing day to day activities *a lot of difficulty getting around inside and outside *moderate physical pain *only occasionally exhausted *sometimes have trouble concentrating/thinking clearly *only occasionally lonely *often sad/depressed *only occasionally anxious *never feel unable to cope with your day to day life	*slight difficulty doing day to day activities *slight difficulty getting around inside and outside *moderate physical pain *never exhausted *only occasionally have trouble concentrating/thinking clearly *only occasionally lonely *only occasionally sad/depressed *anxious most or all of the time *sometimes feel unable to cope with your day to day life
*a lot of difficulty doing day to day activities *no difficulty getting around inside and outside *very severe physical pain *often exhausted *only occasionally have trouble concentrating/thinking clearly *sometimes lonely *only occasionally sad/depressed *never anxious *often feel unable to cope with your day to day life	*no difficulty doing day to day activities *some difficulty getting around inside and outside *severe physical pain *often exhausted *sometimes have trouble concentrating/thinking clearly *often lonely *often sad/depressed *only occasionally anxious *feel unable to cope with your day to day life most or all of the time
*slight difficulty doing day to day activities *unable to get around inside and outside *severe physical pain *only occasionally exhausted *only occasionally have trouble concentrating/thinking clearly *never lonely *never sad/depressed *anxious most or all of the time *sometimes feel unable to cope with your day to day life	*a lot of difficulty doing day to day activities *no difficulty getting around inside and outside *very severe physical pain *never exhausted *have trouble concentrating/thinking clearly most or all of the time *lonely most or all of the time *sad/depressed most or all of the time *sometimes anxious *feel unable to cope with your day to day life most or all of the time
*a lot of difficulty doing day to day activities *a lot of difficulty getting around inside and outside *moderate physical pain *only occasionally exhausted *sometimes have trouble concentrating/thinking clearly *only occasionally lonely *often sad/depressed *only occasionally anxious *never feel unable to cope with your day to day life	*no difficulty doing day to day activities *a lot of difficulty getting around inside and outside *very severe physical pain *only occasionally exhausted *often have trouble concentrating/thinking clearly *only occasionally lonely *sad/depressed most or all of the time *often anxious *only occasionally feel unable to cope with your day to day life

Appendix 3: Topic Guide Questions

TTO component

1. What influenced your decisions when you were asked to make choices between Life A and Life B with changing number of years of life?

2. Looking at an example state from your first set of questions [show example card] were there any aspects of health and quality of life that:
    a. you **always** took into account when making decisions? Why?
    b. you **never** took into account when making decisions? Why?

3. Looking at an example state from your second set of questions [show example card] were there any aspects of health and quality of life that:
    a. you **always** took into account when making decisions? Why?
    b. you **never** took into account when making decisions? Why?

4. I'd like to ask some questions comparing the questionnaire used in the first set of questions compared to the second set

    a. What did you think of the two questionnaires (EQ-5D and EQ-HWB) you completed?
        i. Was any easier to compete and why?
        ii. Were there any questions that were unclear or difficult to answer? Why?
    b. The descriptions for Life B were drawn from these questionnaires. How did you find imagining what life would be like when comparing the two descriptions? Was any easier to imagine, why? Was it easy to imagine living in that state for 10 years?
    c. How did you find making the choice when comparing the two different descriptions for Life B [show example]? *Prompts and questions*
        i. Did you find it more difficult to make choices for particular descriptions – which ones & why?
        ii. Did you find it easier to make choices for particular descriptions – which ones & why
        iii. Did having more quality of life information into the description affect how you found answering the questions?
    d. Do you have any other thoughts about the longer descriptions?

Pairwise comparison

5. Thinking about the task where Life A and Life B were both descriptions of health and quality of life, how did you find doing the task? *Prompts*
    a. What influenced your decisions when you were asked to make choices comparing two descriptions of health and quality of life?
    b. Were there any parts of the description that you did not think were important? Which ones and why? Did they influence your decisions?
    c. Do you recall if there were any comparisons that were particularly easy to make? Why? [Include paper-based copies for reference?]
    d. Do you recall if there were any comparisons that were particularly difficult to make? Why?

e. Did you use any techniques or short cuts to help make the task easier or quicker?

6. This is an example of a description where some of the information across Life A and Life B are the same. The statements that are different have been highlighted. Please read through the statements and make a choice between Life A and Life B.
    a. How did you make your choice? [Did you use all the information when making your choice?]
    b. Compared to the task that you did on the computer, how did you find making a choice?
    c. Is there anything else that would help in making the choices in this task?

7. Finally, thinking about the first task where you compared a description with full health and time varied and this second task, where you just compared descriptions:
    a. Which task did you find the easiest to understand what you had to do? Why?
    b. Which task did you find the easiest to choose an answer? Why?