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Developing a dementia-specific preference-based quality of life measure (AD-5D) in Australia: Valuation study protocol

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1 **Developing a dementia-specific preference-based quality of life measure (AD-**
2 **5D) in Australia: Valuation study protocol**

3 Comans TA^{1*}, Nguyen K-H¹, Mulhern B², Corlis M³, Li L¹, Welch A¹, Kurrle S⁴, Rowen D⁵, Moyle W¹,
4 Kularatna S⁶, Ratcliffe J⁷

5
6 ¹ Menzies Health Institute, Griffith University, Brisbane, Australia

7 ² Centre for Health Economics Research and Evaluation, University of Technology Sydney, Sydney,
8 Australia

9 ³ Helping Hand Aged Care, North Adelaide, Australia

10 ⁴ Sydney Medical School, University of Sydney, Sydney, Australia

11 ⁵ Health Economics and Decision Science, School of Health and Related Research, University of
12 Sheffield, Sheffield, UK

13 ⁶ Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane,
14 Australia

15 ⁷ Institute for Choice, UniSA Business School, University of South Australia, Adelaide, South Australia,
16 Australia

17 * corresponding author: t.comans@griffith.edu.au

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19 **Keywords:** dementia, utility weight, quality adjusted life year, discrete choice experiment, best worst
20 scaling

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23 ABSTRACT

24 **Introduction:** Generic instruments for assessing health-related quality of life may lack the sensitivity to
25 detect changes in health specific to certain conditions, such as dementia. The QOL-AD is a widely used
26 and well validated condition-specific instrument for assessing health-related quality of life for people
27 living with dementia, but it does not enable the calculation of Quality Adjusted Life Years (QALYs), the
28 basis of cost utility analysis. This study will generate a preference-based scoring algorithm for a health
29 state classification system (the AD-5D) derived from the QOL-AD.

30 **Methods and analysis:** Discrete choice experiments with duration (DCE_{TTO}) and best-worst scaling
31 (BWS) health state valuation tasks will be administered to a representative sample of 2,000 members of
32 the Australian general population via an online survey and to 250 dementia dyads (250 people with
33 dementia and their carers) via face-to-face interview. A multinomial (conditional) logistic framework will
34 be used to analyse responses and produce the utility algorithm for the AD-5D.

35 **Ethics and dissemination:** The algorithms developed will enable prospective and retrospective
36 economic evaluation of any treatment or intervention targeting people with dementia where the QOL-AD
37 has been administered and will be available online. Results will be disseminated through journals that
38 publish health economics articles and through professional conferences. The study has ethical approval.

41 Strengths and limitations of this study

- 42 • Utility values will be able to be calculated for any treatment or intervention targeting people with
43 dementia where the QOL-AD has been administered.
- 44 • Preference value sets from both general population and dementia dyads will be available
- 45 • The study has a broad range of investigators with input in the design from consumers and aged care
46 organisations
- 47 • The ability of the study to generate specific algorithms for people with dementia and their carers will
48 be impacted if recruitment targets are not met

50 INTRODUCTION

51 Economic evaluation has become widely utilised as a method for assessing the value for money of health
52 intervention programs in Australia and overseas ¹. The most prevalent form of economic evaluation is
53 cost utility analysis, which compares interventions in terms of their incremental cost per quality adjusted
54 life year (QALY). The QALY is a single measure of outcome that takes into account both quantity of life
55 (survival) and health-related quality of life (morbidity). The measurement of QALYs relies on a single
56 preference-based index measure of health: a utility weight.

57 There are a large number of health-related quality of life instruments available to derive utility weights.
58 The most frequently used are generic instruments suitable for any health condition; however an
59 increasing number of condition-specific instruments are available. All preference-based measures have
60 two common elements: a health-state classification system that can be used to categorise all patients with
61 the condition of interest; and a means of obtaining a utility score for all states defined by the
62 classification system ².

63 Previous studies assessing the health of people with dementia have used both generic (the 15D ³⁻⁵,
64 Assessment of Quality of life (AQoL) ⁶⁻⁸, Quality of Well-being (QWB) ⁹⁻¹¹, Health Utilities Index (HUI)
65 ¹²⁻¹⁴, EQ-5D ¹⁵⁻¹⁷) and disease-specific (DEMQOL-U ^{2,18,19}) preference-based instruments. Generic
66 instruments are regularly recommended by health technology assessment (HTA) organisations and
67 regulatory authorities on the basis that they facilitate comparisons across different health conditions and
68 diseases ²⁰, thus addressing the health system's objective of allocative efficiency. However, generic
69 instruments may lack the coverage to detect change in important aspects of certain conditions. For
70 example, the five dimensions of EQ-5D lack attributes to capture cognition ²¹ and relationships with
71 family and social support ²² that are important domains in measuring the quality of life of people with
72 dementia. Those limitations have motivated the recent development of the DEMQOL-U, a preference-
73 based instrument generated from the DEMQOL, a dementia-specific quality of life instrument ²³.
74 However, the DEMQOL-U's use for people with dementia may be limited because it does not directly
75 measure physical health dimensions ¹⁸ and is time consuming to complete ²⁴.

76 Our team has recently developed a new health state classification system, the AD-5D ²⁵ based on the
77 QOL-AD nursing home version ²⁶. The QOL-AD, originally developed for people with dementia living in
78 the community ²⁷, is the quality of life measure for people with dementia recommended in European
79 guidelines due to its brevity, validity and wide usage ²⁸. The AD-5D development process involved the
80 use of statistical methods (psychometric, factor and Rasch analyses) to identify five key dimensions
81 ('memory', 'mood', 'physical health', 'living situation' and 'do things for fun') and subsequently select
82 items to represent the dimensions and generate the health state classification system. These five items
83 appear in both QOL-AD nursing home and community versions.

84 The purpose of this study is to generate a preference-based scoring algorithm for the AD-5D, the health
85 state classification system derived from the QOL-AD. This will be achieved by eliciting values for a

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86 selection of health states and conducting statistical modelling to develop an algorithm that derives utility
87 values for all possible health states defined by the AD-5D descriptive system. This paper describes the
88 process and methodology we will use to develop the utility values for the AD-5D (summarised in Figure
89 1). When complete, this algorithm will enable data collected from any administration of the QOL-AD to
90 be used in the economic evaluation of treatments and interventions for people diagnosed with dementia.

91 **Figure 1: Process and methodology of the AD-5D project**

92 [INSERT FIGURE 1 HERE]

93 **AIMS**

94 This study has two main objectives:

- 95 • To value health states from the AD-5D descriptive system with a representative sample of the general
96 population and a sample of dementia dyads (a person with dementia and a primary carer) in Australia
97 using discrete choice experiment with duration (DCE_{TTO}) and best-worst scaling (BWS) elicitation
98 techniques.
- 99 • To identify any potential differences in the utility values elicited from the general population and
100 those from the dementia dyads, and between the two elicitation methods of DCE and BWS.

101 **METHODS AND ANALYSIS**

102 **Preference elicitation methods**

103 The most commonly used preference elicitation methods for valuing health states include standard
104 gamble (SG) ^{12,29,30}, time trade-off (TTO) ^{2,31,32}, discrete choice experiment (DCE) ³³⁻³⁵ and best-worst
105 scaling (BWS) (a particular form of DCE) ³⁶⁻³⁸. Historically, researchers have favoured the SG and TTO
106 to value health states ²⁰. However, these methods have been criticised on the grounds of task complexity
107 ³⁹, intensity of administration ⁴⁰, and potential contamination by risk attitudes and time preference ⁴¹.
108 Consequently, methods such as DCE and BWS have gained significant popularity in health economics
109 research because they use an ordinal ranking procedure, and therefore present a different cognitive
110 challenge for respondents, avoiding the use of iterative procedures ^{42,43}. They can also be administered in
111 both face-to-face and online settings, while online survey methodology for SG and TTO arguably
112 requires further development to guarantee reliable results ^{44,45}.

113 In this project, we will use DCE with survival duration (DCE_{TTO}) and BWS to elicit preferences for
114 health states described by the AD-5D. A DCE presents individuals with a number of hypothetical health
115 states (i.e. choice sets), each containing a number of alternatives with different attributes between which
116 individuals are asked to choose. While this form of DCE can provide information on the relative
117 preference of one health state over others, its derived values are not anchored on the zero-one utility scale
118 ⁴⁶, thus cannot be used directly for QALY calculation. The DCE_{TTO} method was developed to directly
119 anchor relative preferences to the utility scale through the inclusion of a survival/duration attribute, while

1
2 120 fitting within the constraints of random utility theory⁴⁶. In our DCE_{TTO}, choice sets presenting levels of
3 121 the five dimensions of the AD-5D (memory, mood, physical health, living situation and do things for fun)
4 122 and one survival duration attribute will be presented. Each dimension has four ordinal severity levels
5 123 ('excellent', 'good', 'fair' and 'poor'). A duration attribute with four levels (1, 4, 7, and 10 years) will be
6 124 included to investigate individuals' preferences with respect to survival durations.

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9 125 BWS is a stated-preference method that presents respondents with a series of hypothetical health states
10 126 and asks them to identify each state's best and worst attribute, hence offering the ability to compare
11 127 attributes and associated levels within a single health state. Compared to a DCE_{TTO}, BWS is less
12 128 cognitively complex and may therefore be more appropriate for vulnerable groups such as older people or
13 129 people with limited cognitive function⁴⁷⁻⁴⁹. In this project we will use a profile case BWS⁵⁰, in each of
14 130 the tasks, respondents will be asked to pick the best and worst attribute of a health state³⁸.

131 **Experimental design and construction of choice sets**

132 ***Discrete choice experiment tasks***

133 The experimental design needs to determine both the total number of health states to be included in the
134 134 valuation study and the combinations of health states to be valued by each respondent. The combination
135 135 of attributes (five AD-5D dimensions and one duration) and levels (four levels for each attribute) results
136 136 in the full factorial of 4096 possible health state profiles, and over 16 million possible pairwise
137 137 combinations (4096 × 4095). For practical purposes, a subset of these will be selected from a candidate
138 138 set to reduce the number of health states used in the experiment, whilst maximising the efficiency of the
139 139 design.

140 A design maximised for the multinomial logit (MNL) model based on D-efficiency criteria will be used
141 141 to generate 200 pairwise choice sets using the design software NGene⁵¹. We will generate a design that
142 142 can estimate the health state dimension and duration level main effects, as well as interactions between
143 143 the health state dimensions and duration required to anchor DCE_{TTO} data on the full health – dead scale.
144 144 Previous research suggests that participants can efficiently handle 10 choice sets at a time if they do not
145 145 have any cognitive impairment⁴⁷, while 5-6 choice sets are optimal for people with mild cognitive
146 146 impairment⁵². Consequently, the full design will be divided into 20 blocks (versions) of the survey with
147 147 10 choice sets per block for the general population survey, and 40 blocks with 5 choice sets per block for
148 148 the dementia dyads interview. The blocking design will ensure balance among attribute levels⁵³. The
149 149 construction of choice sets will also allow both the main effects (the effect of each attribute) and
150 150 interaction effects between the attribute and duration to be determined. An example of a DCE_{TTO} choice
151 151 task is shown in Table 1.

152 **Table 1: Presentation of a DCE task**

	Health Description A	Health Description B
	You have poor physical health	You have excellent physical health
	You have good mood	You have fair mood
	You have fair memory	You have fair memory
	You have good living situation	You have fair living situation
	You have good ability to do things for fun	You have good ability to do things for fun
	You live in this state for 4 years and then you die.	You live in this state for 7 years and then you die.
Which scenario do you think is better?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

153 ***Best-worst scaling task***

154 In each BWS choice set, only one health state based on the AD-5D is included. An orthogonal array will
 155 generate health state profiles for use in the BWS in order to minimise multicollinearity among different
 156 levels of the attributes, thus optimising the design. A total of 16 health states will be generated. The full
 157 design is separated into four blocks so that each respondent will be presented with four choice sets for
 158 valuation. The blocks will be used for both the general population survey and dementia dyad interviews.
 159 An example of a BWS choice task is shown in Table 2.

160 **Table 2: Presentation of a BWS task**

Best	Health Description	Worst
O	You have good memory	O
O	You have poor mood	O
O	You have excellent physical health	O
O	You have fair living situation	O
O	You have fair ability to do things for fun	O

161 **Survey format**

162 Debate exists as to whose preferences are important when assessing health care⁵⁴. A prevailing view is
 163 that the general public funds services in a public health system and therefore their preferences should be
 164 taken into account when assessing programs for funding. On the contrary, other views are that only
 165 people who have experienced the condition could provide a reasonable perspective to inform preferences
 166 for that condition. Patient and public preferences can vary, with the public often framing aspects such as
 167 mobility and leisure constraints more negatively than people experiencing a condition where these

1 168 aspects are impacted⁵⁵. In our project, the survey will be administered to both the general population and
2
3 169 to dementia dyads so that either value is available to inform economic evaluations.

4 5 170 ***General public***

6
7 171 A web-based survey that contains three modules will be administered to a sample of the Australian
8
9 172 general population in October to December 2017. In the first module, respondents will be given an
10
11 173 introduction to the study and required to provide consent in order to continue the survey. Demographic
12
13 174 data will be collected (e.g., gender, age, education, marital status and employment), that can be used to
14
15 175 determine the representativeness of the sample compared with the Australian population. In addition,
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17 176 respondents will be required to self-complete two quality of life questionnaires, the EQ-5D-5L and the
18
19 177 QOL-AD (community living version) before commencing the main tasks.

20
21 178 The second and third modules will contain the DCE_{TTO} tasks (ten choice sets) and the BWS tasks (four
22
23 179 choice sets). The order of these modules will be randomly assigned to eliminate order effects bias in the
24
25 180 responses: half of the general population sample will complete DCE_{TTO} first, the other half BWS first. At
26
27 181 the start of each module, respondents will be given information and instructions on how to complete the
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29 182 DCE_{TTO} or BWS tasks, and shown a sample task. To assess internal reliability and consistency of
30
31 183 responses, one repeated choice set (from each of the DCE_{TTO} or BWS blocks) and one dominant choice
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33 184 set will be included, creating 12 DCE and 6 BWS choice sets to be presented to each general population
34
35 185 participant.

36
37 186 At the end of the DCE_{TTO} and BWS modules, respondents will be asked to rate their difficulty completing
38
39 187 each task. At the end of the survey, respondents will be asked to compare the difficulty levels between
40
41 188 DCE_{TTO} and BWS tasks and provide information on their prior experience of dementia.

42 43 189 ***Dementia dyads (one person with dementia and a primary carer)***

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45 190 A survey with three modules will be administered to dementia dyads during a face-to-face interview. The
46
47 191 first module will collect basic demographic data (e.g., gender, age, education, marital status and
48
49 192 employment), experience with dementia such as type of dementia, time since formal diagnosis, and
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51 193 quality of life (using the EQ-5D-5L and the QOL-AD). The person with dementia will complete a GP-
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53 194 Cog task as a quick reliable screen of cognitive function⁵⁶, while the carer will be asked questions about
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55 195 their care experience, time commitment and her/his own health. The second and third modules consist of
56
57 196 DCE_{TTO} and BWS tasks. In order to reduce the cognitive burden for people with dementia, fewer choice
58
59 197 sets (five DCE_{TTO} choice sets and four BWS choice sets) will be administered during interviews⁵⁷. A
60
198 standard script will be created as part of the interview protocol to explain the DCE_{TTO} and BWS tasks to
199 dementia dyads in plain language, with standard prompts if required.

200 **Sample size and recruitment**

201 201 Two different samples are required to achieve the study objectives: the general population and the
202
202 202 dementia dyad. The current theory of sampling determines that sample sizes are based upon the

1
2 203 characteristics of the study design, such as the number of attributes, the size of the population and the
3 204 statistical power that is required of the model derived. Based on the suggestions in the literature and
4 205 previous studies using DCE_{TTO} and BWS methodology [40],[47], we have set our recruitment target at
5 206 2,000 members of the general population and 250 dementia dyads (250 people with dementia and 250
6 207 carers).

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9 208 Quotas will be set for age, gender and geographic area during recruitment for the online survey to ensure
10 209 the sample is representative of the Australian population. Survey respondents will be sourced from an
11 210 existing Australian online panel, administered by PureProfile Pty Ltd. This panel is drawn from
12 211 volunteers (aged 18 and above and able to give consent) in the general population who are paid a small
13 212 amount by the panel administrators for completion of the survey. The advantage of this approach is that a
14 213 population can be drawn from the total available chosen based on pre-specified criteria such as age and
15 214 gender, thereby ensuring that a broadly representative population sample is obtained. Each respondent
16 215 will use a web link to access the survey, so is able to self-complete at their convenience.

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19 216 A sample of dementia dyads will be recruited from Queensland, New South Wales and South Australia
20 217 from October 2017 to September 2018. A comprehensive recruitment approach will be undertaken by
21 218 contacting eligible participants through aged care providers, residential aged care facilities and
22 219 community centres in both metropolitan and regional areas. Purposeful sampling will be used with quotas
23 220 set (e.g. residential and community dwelling, gender, age) to ensure the generalisability of the findings.
24 221 The dyad will be considered eligible to participate in the interview if the person with dementia has mild
25 222 to moderate cognitive impairment (assessed using the GP-Cog), is able to provide informed consent and a
26 223 trained interviewer (with experience in dementia care) determines the person with dementia understands
27 224 the survey tasks.

28 225 **Pilot study**

29
30 226 Pilot studies will be conducted with a subset of 200 (of 2,000) from the general population sample and 25
31 227 (of 250) dementia dyads. The pilot aims to ascertain comprehension and understanding of the choice set
32 228 tasks, attributes and their levels as well as the functioning of the survey instrument. The pilot will
33 229 highlight any procedural issues for the experimental design of the survey and allow revisions if required.
34 230 The average time taken during the online survey pilot will be used to set a minimum time for respondents
35 231 to complete the main survey. Data from the pilot will be analysed to confirm the face validity of the
36 232 survey instrument.

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39 233 A think-aloud technique will be used in the pilot interviews with the dementia dyads to gauge participant
40 234 understanding of the tasks and provide insight into the factors underlying the preferences of participants
41 235⁵⁹. By using the ‘think aloud’ approach during the pilot, we are asking respondents to explain their
42 236 thought process for making choices. If they repeatedly indicate they don’t understand, or if the
43 237 interviewer (who has experience working with people with dementia) deems they don’t understand,

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2 238 transcripts and recordings of the interviews will be used by the research team, combined with GP-Cog
3 239 scores, to review the recruitment and interviewing process for the remaining dyads.

4
5 240 **Analytical plan**

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7 241 We will use a multinomial (conditional) logistic (MNL) framework as outlined by McFadden⁶⁰ to
8 242 analyse both DCE_{TTO} and BWS responses. For both DCE_{TTO} and BWS, random effect utility functions
9 243 will be estimated following the Random Utility Theory's argument that the utility value that an individual
10 244 attaches to an attribute in a choice scenario can be summarised by an explainable (fixed) component and
11 245 an unexplainable (random) component.

12
13 246 The specific utility function for the DCE_{TTO} responses will be modelled using the approach developed
14 247 and described by Bansback et al⁴⁶ due to its additional time duration attribute. The BWS-based utility
15 248 values will be estimated using a two-stage approach. In stage 1, the coefficients of a random effect utility
16 249 function will be estimated, from which the BWS values will be generated. These values will be anchored
17 250 onto the 1-0 full health-dead scale (required to generate QALYs) in stage 2 by mapping the modelled
18 251 values from a small selection of health states used for AD-5D (ranging from mild to severe impairment)
19 252 generated from the DCE_{TTO} study to the ordinal best-worst estimates to translate the best-worst estimates.
20 253 While this represents a new technique in this field, the process is equivalent to mapping from BWS to
21 254 utility values using TTO⁴⁷ or mapping from DCE to TTO⁴².

22
23 255 **Ethics and Dissemination**

24
25 256 This study has ethical approval from Griffith University HREC No 2016/626. A steering committee
26 257 consisting of researchers, consumers and aged care industry representatives will coordinate the project
27 258 and oversee any concerns arising from the conduct of the research. This committee will meet monthly for
28 259 the duration of the project.

29
30 260 This project will develop utility value sets for a new dementia-specific economic analysis tool, the AD-
31 261 5D. This will be the first dementia specific preference-based measure with an Australian value set. Once
32 262 developed, the AD-5D utility algorithms can be used to generate utility weights from any completion of
33 263 the QOL-AD instrument. The weights can be used to calculate QALYs for the economic evaluation of
34 264 treatments and interventions targeting people with dementia. This algorithm is applicable not only to
35 265 current and future clinical trials and intervention studies but also for previously collected data using the
36 266 QOL-AD, from which the AD-5D was derived.

37
38 267 Dissemination will occur through academic publications and conference presentations. Algorithms
39 268 developed in the project will be available online. As well, the authors will record an online video
40 269 demonstrating the use of the algorithms.

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271 **Footnotes**

272 **Contributors**

273 TAC, KHN, JR, BM, DR conceived the study, all authors contributed to the design of the study, TAC,
274 KHN and LL wrote the manuscript, all authors have read and approved the manuscript.

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281 **Competing interests statement**

282 None declared

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287

288 **References**

- 289 1. Brazier, J. *Measuring and valuing health benefits for economic evaluation*. (Oxford University Press,
290 2007).
- 291 2. Mulhern, B. *et al.* Development of DEMQOL-U and DEMQOL-PROXY-U: Generation of
292 preference-based indices from DEMQOL and DEMQOL-PROXY for use in economic evaluation.
293 *Health Technol. Assess.* **17**, 1–160 (2013).
- 294 3. Laakkonen, M.-L. *et al.* Effects of Self-Management Groups for People with Dementia and Their
295 Spouses—Randomized Controlled Trial. *J. Am. Geriatr. Soc.* **64**, 752–760 (2016).
- 296 4. Karttunen, K. *et al.* Neuropsychiatric symptoms and Quality of Life in patients with very mild and
297 mild Alzheimer’s disease. *Int. J. Geriatr. Psychiatry* **26**, 473–482 (2011).
- 298 5. Sintonen, H. An approach to measuring and valuing health states. *Soc. Sci. Med. [C]* **15**, 55–65
299 (1981).
- 300 6. Hawthorne, G., Richardson, J. & Osborne, R. The Assessment of Quality of Life (AQoL) instrument:
301 a psychometric measure of Health-Related Quality of Life. *Qual. Life Res.* **8**, 209–224 (1999).
- 302 7. Nikmat, A. W., Hawthorne, G. & Al-Mashoor, S. H. The comparison of quality of life among people
303 with mild dementia in nursing home and home care—a preliminary report. *Dementia* **14**, 114–125
304 (2015).
- 305 8. Wlodarczyk, J. H., Brodaty, H. & Hawthorne, G. The relationship between quality of life, Mini-
306 Mental State Examination, and the Instrumental Activities of Daily Living in patients with
307 Alzheimer’s disease. *Arch. Gerontol. Geriatr.* **39**, 25–33 (2004).
- 308 9. Wimo, A. *et al.* Cost-Utility Analysis of Group Living in Dementia Care. *International Journal of*
309 *Technology Assessment in Health Care* (1995). Available at: /core/journals/international-journal-of-
310 technology-assessment-in-health-care/article/costutility-analysis-of-group-living-in-dementia-
311 care/78D0532F797AB8B81BCEE9D28EDB53AD. (Accessed: 16th April 2017)
- 312 10. Kerner, D. N., Patterson, T. L., Grant, I. & Kaplan, R. M. Validity of the Quality of Well-Being
313 Scale for Patients with Alzheimer’s Disease. *J. Aging Health* **10**, 44–61 (1998).
- 314 11. Kaplan, R. M., Bush, J. W. & Berry, C. C. Health status: types of validity and the index of well-
315 being. *Health Serv. Res.* **11**, 478–507 (1976).
- 316 12. Furlong, W. J., Feeny, D. H., Torrance, G. W. & Barr, R. D. The Health Utilities Index (HUI®)
317 system for assessing health-related quality of life in clinical studies. *Ann. Med.* **33**, 375–384 (2001).
- 318 13. Mittmann, N., Trakas, K., Risebrough, N. & Liu, B. A. Utility Scores for Chronic Conditions in a
319 Community-Dwelling Population. *PharmacoEconomics* **15**, 369–376 (1999).

- 1
2 320 14. Neumann, P. J. *et al.* Health Utilities in Alzheimer's Disease: A Cross-Sectional Study of Patients
3 321 and Caregivers. *Med. Care* **37**, 27–32 (1999).
- 4
5 322 15. EuroQol Group. EuroQol - a new facility for the measurement of health-related quality of life.
6 323 *Health Policy* **16**, 199–208 (1990).
- 7
8 324 16. Orgeta, V., Edwards, R. T., Hounsome, B., Orrell, M. & Woods, B. The use of the EQ-5D as a
9 325 measure of health-related quality of life in people with dementia and their carers. *Qual. Life Res.* **24**,
10 326 315–324 (2015).
- 11
12 327 17. Aguirre, E., Kang, S., Hoare, Z., Edwards, R. T. & Orrell, M. How does the EQ-5D perform when
13 328 measuring quality of life in dementia against two other dementia-specific outcome measures? *Qual.*
14 329 *Life Res.* **25**, 45–49 (2016).
- 15
16 330 18. Mulhern, B. *et al.* Improving the Measurement of QALYs in Dementia: Developing Patient- and
17 331 Carer-Reported Health State Classification Systems Using Rasch Analysis. *Value Health* **15**, 323–
18 332 333 (2012).
- 19
20 333 19. Rowen, D. *et al.* Estimating Preference-Based Single Index Measures for Dementia Using DEMQOL
21 334 and DEMQOL-Proxy. *Value Health* **15**, 346–356 (2012).
- 22
23 335 20. Drummond, M., Sculpher, M. J., Claxton, K., Stoddart, G. L. & Torrance, G. W. *Methods for the*
24 336 *economic evaluation of health care programmes*. (Oxford University Press, 2015).
- 25
26 337 21. Hounsome, N., Orrell, M. & Edwards, R. T. EQ-5D as a Quality of Life Measure in People with
27 338 Dementia and Their Carers: Evidence and Key Issues. *Value Health* **14**, 390–399 (2011).
- 28
29 339 22. Neumann, P. J. Health utilities in Alzheimer's disease and implications for cost-effectiveness
30 340 analysis. *Pharmacoeconomics* **23**, 537–541 (2005).
- 31
32 341 23. Arons, A. M. M., Schölzel-Dorenbos, C. J. M., Olde Rikkert, M. G. M. & Krabbe, P. F. M. A Simple
33 342 and Practical Index to Measure Dementia-Related Quality of Life. *Value Health* **19**, 60–65 (2016).
- 34
35 343 24. Rowen, D. *et al.* Comparison of General Population, Patient, and Carer Utility Values for Dementia
36 344 Health States. *Med. Decis. Making* **35**, 68–80 (2015).
- 37
38 345 25. Nguyen, K.-H. *et al.* Developing a dementia-specific health state classification system for a new
39 346 preference-based instrument AD-5D. *Health Qual. Life Outcomes* **15**, 21 (2017).
- 40
41 347 26. Edelman, P., Fulton, B. R., Kuhn, D. & Chang, C.-H. A Comparison of Three Methods of Measuring
42 348 Dementia-Specific Quality of Life: Perspectives of Residents, Staff, and Observers. *The*
43 349 *Gerontologist* **45**, 27–36 (2005).
- 44
45 350 27. Logsdon, R. G., Gibbons, L. E., McCurry, S. M. & Teri, L. Quality of life in Alzheimer's disease:
46 351 patient and caregiver reports. *J. Ment. Health Aging* **5**, 21–32 (1999).
- 47
48
49
50
51
52
53
54
55
56
57
58
59
60

- 1
2 352 28. Moniz-Cook, E. *et al.* A European consensus on outcome measures for psychosocial intervention
3 353 research in dementia care. *Aging Ment. Health* **12**, 14–29 (2008).
- 4
5 354 29. Von Neumann, J. *Theory of games and economic behavior*. (Princeton University Press, 2004).
- 6
7 355 30. Brazier, J., Roberts, J. & Deverill, M. The estimation of a preference-based measure of health from
8 356 the SF-36. *J. Health Econ.* **21**, 271–292 (2002).
- 9
10
11 357 31. Torrance, G. W., Thomas, W. H. & Sackett, D. L. A Utility Maximization Model for Evaluation of
12 358 Health Care Programs. *Health Serv. Res.* **7**, 118–133 (1972).
- 13
14 359 32. Dolan, P., Gudex, C., Kind, P. & Williams, A. The time trade-off method: Results from a general
15 360 population study. *Health Econ.* **5**, 141–154 (1996).
- 16
17
18 361 33. Kim, S.-H. *et al.* The EQ-5D-5L valuation study in Korea. *Qual. Life Res.* **25**, 1845–1852 (2016).
- 19
20 362 34. Ratcliffe, J., Brazier, J., Tsuchiya, A., Symonds, T. & Brown, M. Using DCE and ranking data to
21 363 estimate cardinal values for health states for deriving a preference-based single index from the sexual
22 364 quality of life questionnaire. *Health Econ.* **18**, 1261–1276 (2009).
- 23
24 365 35. Propper, C. Contingent Valuation of Time Spent on NHS Waiting Lists. *Econ. J.* **100**, 193–199
25 366 (1990).
- 26
27
28 367 36. Coast, J. *et al.* Valuing the ICECAP capability index for older people. *Soc. Sci. Med.* **67**, 874–882
29 368 (2008).
- 30
31
32 369 37. Ratcliffe, J. *et al.* Valuing the Child Health Utility 9D: Using profile case best worst scaling methods
33 370 to develop a new adolescent specific scoring algorithm. *Soc. Sci. Med.* **157**, 48–59 (2016).
- 34
35 371 38. Louviere, J. J. & Woodworth, G. G. Best-worst scaling: A model for the largest difference
36 372 judgments. *Univ. Alta. Work. Pap.* (1991).
- 37
38
39 373 39. Keeney, R. L. & Winterfeldt, D. von. A Prescriptive Risk Framework for Individual Health and
40 374 Safety Decisions. *Risk Anal.* **11**, 523–533 (1991).
- 41
42 375 40. Ali, S. & Ronaldson, S. Ordinal preference elicitation methods in health economics and health
43 376 services research: using discrete choice experiments and ranking methods. *Br. Med. Bull.* **103**, 21–44
44 377 (2012).
- 45
46
47 378 41. Bleichrodt, H. A new explanation for the difference between time trade-off utilities and standard
48 379 gamble utilities. *Health Econ.* **11**, 447–456 (2002).
- 49
50
51 380 42. Rowen, D., Brazier, J. & Van Hout, B. A Comparison of Methods for Converting DCE Values onto
52 381 the Full Health-Dead QALY Scale. *Med. Decis. Making* **35**, 328–340 (2015).
- 53
54
55 382 43. Robinson, A., Spencer, A. & Moffatt, P. A Framework for Estimating Health State Utility Values
56 383 within a Discrete Choice Experiment: Modeling Risky Choices. *Med. Decis. Making* **35**, 341–350
57 384 (2015).
- 58
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41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
- 385 44. Oppe, M., Devlin, N. J., van Hout, B., Krabbe, P. F. M. & de Charro, F. A Program of
386 Methodological Research to Arrive at the New International EQ-5D-5L Valuation Protocol. *Value*
387 *Health* **17**, 445–453 (2014).
- 388 45. Norman, R. *et al.* Does mode of administration matter? Comparison of online and face-to-face
389 administration of a time trade-off task. *Qual. Life Res.* **19**, 499–508 (2010).
- 390 46. Bansback, N., Brazier, J., Tsuchiya, A. & Anis, A. Using a discrete choice experiment to estimate
391 health state utility values. *J. Health Econ.* **31**, 306–318 (2012).
- 392 47. Netten, A. *et al.* Outcomes of social care for adults: developing a preference-weighted measure.
393 *Health Technol. Assess. Winch. Engl.* **16**, 1–166 (2012).
- 394 48. Flynn, T. N. Valuing citizen and patient preferences in health: recent developments in three types of
395 best–worst scaling. *Expert Rev. Pharmacoecon. Outcomes Res.* **10**, 259–267 (2010).
- 396 49. Flynn, T. N., Louviere, J. J., Peters, T. J. & Coast, J. Best–worst scaling: What it can do for health
397 care research and how to do it. *J. Health Econ.* **26**, 171–189 (2007).
- 398 50. Flynn, T. & Marley, A. Best-worst scaling: theory and methods. (Edward Elgar, 2014).
- 399 51. Metrics, C. Ngene 1.1. 2. *User Man. Ref. Guide* (2014).
- 400 52. Milte, R. *et al.* Cognitive Overload? An Exploration of the Potential Impact of Cognitive Functioning
401 in Discrete Choice Experiments with Older People in Health Care. *Value Health* **17**, 655–659 (2014).
- 402 53. Reed Johnson, F. *et al.* Constructing Experimental Designs for Discrete-Choice Experiments: Report
403 of the ISPOR Conjoint Analysis Experimental Design Good Research Practices Task Force. *Value*
404 *Health* **16**, 3–13 (2013).
- 405 54. Stamuli, E. Health outcomes in economic evaluation: who should value health? *Br. Med. Bull.* **97**,
406 197–210 (2011).
- 407 55. Peeters, Y., Vliet Vlieland, T. P. M. & Stiggelbout, A. M. Focusing illusion, adaptation and EQ-5D
408 health state descriptions: the difference between patients and public. *Health Expect.* **15**, 367–378
409 (2012).
- 410 56. Brodaty, H., Kemp, N. M. & Low, L.-F. Characteristics of the GPCOG, a screening tool for
411 cognitive impairment. *Int. J. Geriatr. Psychiatry* **19**, 870–874 (2004).
- 412 57. Milte, R. *et al.* Cognitive overload? An exploration of the potential impact of cognitive functioning
413 in discrete choice experiments with older people in health care. *Value Health J. Int. Soc.*
414 *Pharmacoeconomics Outcomes Res.* **17**, 655–659 (2014).
- 415 58. Viney, R. *et al.* An Australian Discrete Choice Experiment to Value Eq-5d Health States. *Health*
416 *Econ.* **23**, 729–742 (2014).

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4
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42
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47
48
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50
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53
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56
57
58
59
60

417 59. Whitty, J. A., Walker, R., Golenko, X. & Ratcliffe, J. A Think Aloud Study Comparing the Validity
418 and Acceptability of Discrete Choice and Best Worst Scaling Methods. *PLOS ONE* **9**, e90635
419 (2014).
420 60. McFadden, D. Conditional logit analysis of qualitative choice behavior. (1973).
421

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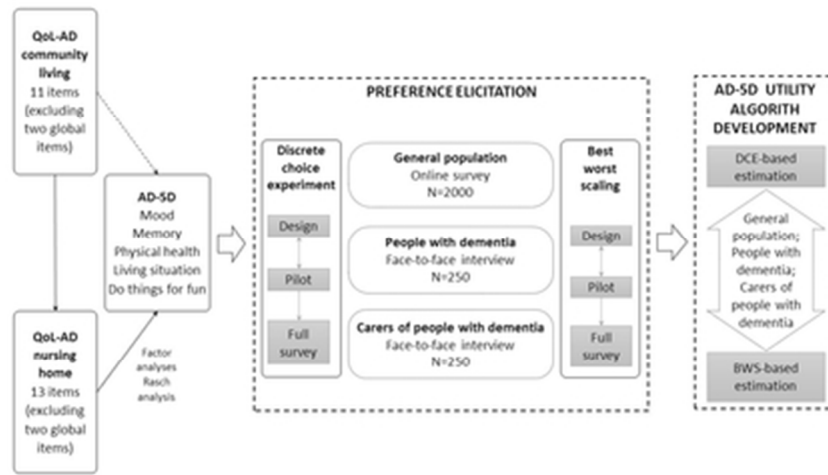


Figure 1: Process and methodology of the AD-5D project

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Developing a dementia-specific preference-based quality of life measure (AD-5D) in Australia: Valuation study protocol

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1 Developing a dementia-specific preference-based quality of life measure (AD- 2 5D) in Australia: Valuation study protocol

3 Comans TA^{1,2} *, Nguyen K-H^{2,3}, Mulhern B⁴, Corlis M,^{2,5} Li L³, Welch A^{1,2}, Kurrle S^{2,6}, Rowen D⁷,
4 Moyle W³, Kularatna S⁸, Ratcliffe J^{2,9}

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1 The Centre for Health Services Research, University of Queensland, St. Lucia, Australia

2 NHMRC's Partnership Centre on Dealing with Cognitive and Related Functional Decline in Older
3 People

4 Menzies Health Institute Queensland, Griffith University, Brisbane, Australia

5 Centre for Health Economics Research and Evaluation, University of Technology Sydney, Sydney,
6 Australia

7 Helping Hand Aged Care, North Adelaide, Australia

8 Sydney Medical School, University of Sydney, Sydney, Australia

9 Health Economics and Decision Science, School of Health and Related Research, University of
10 Sheffield, Sheffield, UK

11 Institute of Health and Biomedical Innovation, Queensland University of Technology, Brisbane,
12 Australia

13 Institute for Choice, UniSA Business School, University of South Australia, Adelaide, South Australia,
14 Australia

15 * Corresponding author: t.comans@uq.edu.au

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Keywords: dementia, utility weight, quality adjusted life year, discrete choice experiment, best worst scaling

33 ABSTRACT

34 **Introduction:** Generic instruments for assessing health-related quality of life may lack the sensitivity to
35 detect changes in health specific to certain conditions, such as dementia. The QOL-AD is a widely used
36 and well validated condition-specific instrument for assessing health-related quality of life for people
37 living with dementia, but it does not enable the calculation of Quality Adjusted Life Years (QALYs), the
38 basis of cost utility analysis. This study will generate a preference-based scoring algorithm for a health
39 state classification system (the AD-5D) derived from the QOL-AD.

40 **Methods and analysis:** Discrete choice experiments with duration (DCE_{TTO}) and best-worst scaling
41 (BWS) health state valuation tasks will be administered to a representative sample of 2,000 members of
42 the Australian general population via an online survey and to 250 dementia dyads (250 people with
43 dementia and their carers) via face-to-face interview. A multinomial (conditional) logistic framework will
44 be used to analyse responses and produce the utility algorithm for the AD-5D.

45 **Ethics and dissemination:** The algorithms developed will enable prospective and retrospective
46 economic evaluation of any treatment or intervention targeting people with dementia where the QOL-AD
47 has been administered and will be available online. Results will be disseminated through journals that
48 publish health economics articles and through professional conferences. The study has ethical approval.

51 Strengths and limitations of this study

- 52 • Utility values will be able to be calculated for any treatment or intervention targeting people with
53 dementia where the QOL-AD has been administered.
- 54 • Preference value sets from both general population and dementia dyads will be modelled and
55 compared.
- 56 • The study has a broad range of investigators with input in the design from consumers and aged care
57 organisations.
- 58 • The valuation methods used may not be readily understood by people with dementia, thereby limiting
59 the ability to value quality of life from their own perspective.
- 60 • The ability of the study to generate specific algorithms for people with dementia and their carers will
61 be impacted if recruitment targets are not met.

62

63 INTRODUCTION

64 Economic evaluation has become widely utilised as a method for assessing the value for money of health
65 intervention programs in Australia and overseas ¹. The most prevalent form of economic evaluation is
66 cost utility analysis, which compares interventions in terms of their incremental cost per quality adjusted
67 life year (QALY). The QALY is a single measure of outcome that takes into account both quantity of life
68 (survival) and health-related quality of life (morbidity). The measurement of QALYs relies on a single
69 preference-based index measure of health: a utility weight.

70 There are a large number of health-related quality of life instruments available to derive utility weights.
71 The most frequently used are generic instruments suitable for any health condition; however an
72 increasing number of condition-specific instruments are available. All preference-based measures have
73 two common elements: a health-state classification system that can be used to categorise all patients with
74 the condition of interest; and a means of obtaining a utility score for all states defined by the
75 classification system ².

76 Previous studies assessing the health of people with dementia have used both generic (the 15D ³⁻⁵,
77 Assessment of Quality of life (AQoL) ⁶⁻⁸, Quality of Well-being (QWB) ⁹⁻¹¹, Health Utilities Index (HUI)
78 ¹²⁻¹⁴, EQ-5D ¹⁵⁻¹⁷) and disease-specific (DEMQOL-U ^{2,18,19}) preference-based instruments. Generic
79 instruments are regularly recommended by health technology assessment (HTA) organisations and
80 regulatory authorities on the basis that they facilitate comparisons across different health conditions and
81 diseases ²⁰, thus addressing the health system's objective of allocative efficiency. However, generic
82 instruments may lack the coverage to detect change in important aspects of certain conditions. For
83 example, the five dimensions of EQ-5D lack attributes to capture cognition ²¹ and relationships with
84 family and social support ²² that are important domains in measuring the quality of life of people with
85 dementia. Those limitations have motivated the recent development of the DEMQOL-U, a preference-
86 based instrument generated from the DEMQOL, a dementia-specific quality of life instrument ²³.
87 However, the DEMQOL-U's use for people with dementia may be limited because it does not directly
88 measure physical health dimensions ¹⁸ and is time consuming to complete ²⁴.

89 Our team has recently developed a new health state classification system, the AD-5D ²⁵ based on the
90 QOL-AD nursing home version ²⁶. The QOL-AD, originally developed for people with dementia living in
91 the community ²⁷, is the quality of life measure for people with dementia recommended in European
92 guidelines due to its brevity, validity and wide usage ²⁸. The AD-5D development process involved the
93 use of statistical methods (psychometric, factor and Rasch analyses) to identify five key dimensions
94 ('memory', 'mood', 'physical health', 'living situation', and 'do things for fun') and subsequently select
95 items to represent the dimensions and generate the health state classification system. These five items
96 appear in both QOL-AD nursing home and community versions.

97 The purpose of this study is to generate a preference-based scoring algorithm for the AD-5D, the health
98 state classification system derived from the QOL-AD. This will be achieved by eliciting values for a

1 99 selection of health states and conducting statistical modelling to develop an algorithm that derives utility
2 100 values for all possible health states defined by the AD-5D descriptive system. This paper describes the
3 101 process and methodology we will use to develop the utility values for the AD-5D (summarised in Figure
4 102 1). When complete, this algorithm will enable data collected from any administration of the QOL-AD to
5 103 be used in the economic evaluation of treatments and interventions for people diagnosed with dementia.
6
7

9 104 **Figure 1: Process and methodology of the AD-5D project**

10 105 [INSERT FIGURE 1 HERE]

11 106 **AIMS**

12 107 This study has two main objectives:

- 13 108 • To value health states from the AD-5D descriptive system with a representative sample of the general
14 109 population and a sample of dementia dyads (a person with dementia and a primary carer) in Australia
15 110 using discrete choice experiment with duration (DCE_{TTO}) and best-worst scaling (BWS) elicitation
16 111 techniques.
- 17 112 • To identify any potential differences in the utility values elicited from the general population and
18 113 those from the dementia dyads, and between the two elicitation methods of DCE and BWS.

19 114 **METHODS AND ANALYSIS**

20 115 **Preference elicitation methods**

21 116 The most commonly used preference elicitation methods for valuing health states include standard
22 117 gamble (SG)^{12,29,30}, time trade-off (TTO)^{2,31,32}, discrete choice experiment (DCE)³³⁻³⁵ and best-worst
23 118 scaling (BWS) (a particular form of DCE)³⁶⁻³⁸. Historically, researchers have favoured the SG and TTO
24 119 to value health states²⁰. However, these methods have been criticised on the grounds of task complexity
25 120³⁹, intensity of administration⁴⁰, and potential contamination by risk attitudes and time preference⁴¹.
26 121 Consequently, methods such as DCE and BWS have gained significant popularity in health economics
27 122 research because they use an ordinal ranking procedure, and therefore present a different cognitive
28 123 challenge for respondents, avoiding the use of iterative procedures^{42,43}. They can also be administered in
29 124 both face-to-face and online settings, while online survey methodology for SG and TTO arguably
30 125 requires further development to guarantee reliable results^{44,45}.

31 126 In this project, we will use DCE with survival duration (DCE_{TTO}) and BWS to elicit preferences for
32 127 health states described by the AD-5D. A DCE presents individuals with a number of hypothetical health
33 128 states (i.e. choice sets), each containing a number of alternatives with different attributes between which
34 129 individuals are asked to choose. While this form of DCE can provide information on the relative
35 130 preference of one health state over others, its derived values are not anchored on the zero-one utility scale
36 131⁴⁶, thus cannot be used directly for QALY calculation. The DCE_{TTO} method was developed to directly
37 132 anchor relative preferences to the utility scale through the inclusion of a survival/duration attribute, while
38 133 fitting within the constraints of random utility theory⁴⁶. In our DCE_{TTO}, choice sets presenting levels of

1 134 the five dimensions of the AD-5D (memory, mood, physical health, living situation and do things for fun)
2 135 and one survival duration attribute will be presented. Each dimension has four ordinal severity levels
3 136 ('excellent', 'good', 'fair' and 'poor'). A duration attribute with four levels (1, 4, 7, and 10 years) will be
4 137 included to investigate individuals' preferences with respect to survival durations.

7 138 BWS is a stated-preference method that presents respondents with a series of hypothetical health states
8 139 and asks them to identify each state's best and worst attribute, hence offering the ability to compare
9 140 attributes and associated levels within a single health state. Compared to a DCE_{TTO}, BWS is less
10 141 cognitively complex and may therefore be more appropriate for vulnerable groups such as older people or
11 142 people with limited cognitive function⁴⁷⁻⁴⁹. In this project we will use a profile case BWS⁵⁰, in each of
12 143 the tasks, respondents will be asked to pick the best and worst attribute of a health state³⁸.

14 144 **Experimental design and construction of choice sets**

15 145 *Discrete choice experiment tasks*

16 146 The experimental design needs to determine both the total number of health states to be included in the
17 147 valuation study and the combinations of health states to be valued by each respondent. The combination
18 148 of attributes (five AD-5D dimensions and one duration) and levels (four levels for each attribute) results
19 149 in the full factorial of 4096 possible health state profiles, and over 16 million possible pairwise
20 150 combinations (4096 × 4095). For practical purposes, a subset of these will be selected from a candidate
21 151 set to reduce the number of health states used in the experiment, whilst maximising the efficiency of the
22 152 design.

23 153 A design maximised for the multinomial logit (MNL) model based on D-efficiency criteria will be used
24 154 to generate 200 pairwise choice sets using the design software NGene⁵¹. We will generate a design that
25 155 can estimate the health state dimension and duration level main effects, as well as interactions between
26 156 the health state dimensions and duration required to anchor DCE_{TTO} data on the full health – dead scale.
27 157 Previous research suggests that participants can efficiently handle 10 choice sets at a time if they do not
28 158 have any cognitive impairment⁴⁷, while 5-6 choice sets are optimal for people with mild cognitive
29 159 impairment⁵². Consequently, the full design will be divided into 20 blocks (versions) of the survey with
30 160 10 choice sets per block for the general population survey, and 40 blocks with 5 choice sets per block for
31 161 the dementia dyads interview. The blocking design will ensure balance among attribute levels⁵³. The
32 162 construction of choice sets will also allow both the main effects (the effect of each attribute) and
33 163 interaction effects between the attribute and duration to be determined. An example of a DCE_{TTO} choice
34 164 task is shown in Table 1.

165 **Table 1: Presentation of a DCE task**

	Health Description A	Health Description B
	You have poor physical health	You have excellent physical health
	You have good mood	You have fair mood
	You have fair memory	You have fair memory
	You have good living situation	You have fair living situation
	You have good ability to do things for fun	You have good ability to do things for fun
	You live in this state for 4 years and then you die.	You live in this state for 7 years and then you die.
Which scenario do you think is better?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

166 ***Best-worst scaling task***

167 In each BWS choice set, only one health state based on the AD-5D is included. An orthogonal array will
 168 generate health state profiles for use in the BWS in order to minimise multicollinearity among different
 169 levels of the attributes, thus optimising the design. A total of 16 health states will be generated. The full
 170 design is separated into four blocks so that each respondent will be presented with four choice sets for
 171 valuation. The blocks will be used for both the general population survey and dementia dyad interviews.
 172 An example of a BWS choice task is shown in Table 2.

173 **Table 2: Presentation of a BWS task**

Best	Health Description	Worst
O	You have good memory	O
O	You have poor mood	O
O	You have excellent physical health	O
O	You have fair living situation	O
O	You have fair ability to do things for fun	O

174 **Survey format**

175 Debate exists as to whose preferences are important when assessing health care⁵⁴. A prevailing view is
 176 that the general public funds services in a public health system and therefore their preferences should be
 177 taken into account when assessing programs for funding. On the contrary, other views are that only
 178 people who have experienced the condition could provide a reasonable perspective to inform preferences
 179 for that condition. Patient and public preferences can vary, with the public often framing aspects such as
 180 mobility and leisure constraints more negatively than people experiencing a condition where these

181 aspects are impacted⁵⁵. In our project, the survey will be administered to both the general population and
182 to dementia dyads so that either value is available to inform economic evaluations.

183 ***General public***

184 A web-based survey that contains three modules will be administered to a sample of the Australian
185 general population in October to December 2017. In the first module, respondents will be given an
186 introduction to the study and required to provide consent in order to continue the survey. Demographic
187 data will be collected (e.g., gender, age, education, marital status and employment), that can be used to
188 determine the representativeness of the sample compared with the Australian population. In addition,
189 respondents will be required to self-complete two quality of life questionnaires, the EQ-5D-5L and the
190 QOL-AD (community living version) before commencing the main tasks.

191 The second and third modules will contain the DCE_{TTO} tasks (ten choice sets) and the BWS tasks (four
192 choice sets). The order of these modules will be randomly assigned to eliminate order effects bias in the
193 responses: half of the general population sample will complete DCE_{TTO} first, the other half BWS first. At
194 the start of each module, respondents will be given information and instructions on how to complete the
195 DCE_{TTO} or BWS tasks, and shown a sample task. To assess internal reliability and consistency of
196 responses, one repeated choice set (from each of the DCE_{TTO} or BWS blocks) and one dominant choice
197 set will be included, creating 12 DCE and 6 BWS choice sets to be presented to each general population
198 participant.

199 At the end of the DCE_{TTO} and BWS modules, respondents will be asked to rate their difficulty completing
200 each task. At the end of the survey, respondents will be asked to compare the difficulty levels between
201 DCE_{TTO} and BWS tasks and provide information on their prior experience of dementia.

202 ***Dementia dyads (one person with dementia and a primary carer)***

203 A survey with three modules will be administered to dementia dyads during a face-to-face interview. The
204 first module will collect basic demographic data (e.g., gender, age, education, marital status and
205 employment), experience with dementia such as type of dementia, time since formal diagnosis, and
206 quality of life (using the EQ-5D-5L and the QOL-AD). The person with dementia will complete a GP-
207 Cog task as a quick reliable screen of cognitive function⁵⁶, while the carer will be asked questions about
208 their care experience, time commitment and her/his own health. The second and third modules consist of
209 DCE_{TTO} and BWS tasks. In order to reduce the cognitive burden for people with dementia, fewer choice
210 sets (five DCE_{TTO} choice sets and four BWS choice sets) will be administered during interviews⁵⁷. A
211 standard script will be created as part of the interview protocol to explain the DCE_{TTO} and BWS tasks to
212 dementia dyads in plain language, with standard prompts if required.

213 **Sample size and recruitment**

214 Two different samples are required to achieve the study objectives: the general population and the
215 dementia dyad. The current theory of sampling determines that sample sizes are based upon the

1 216 characteristics of the study design, such as the number of attributes, the size of the population and the
2 217 statistical power that is required of the model derived. Based on the suggestions in the literature and
3 218 previous studies using DCE_{TTO} and BWS methodology^{40, 47}, we have set our recruitment target at 2,000
4 219 members of the general population and 250 dementia dyads (250 people with dementia and 250 carers).

7 220 Quotas will be set for age, gender and geographic area during recruitment for the online survey to ensure
8 221 the sample is representative of the Australian population. Survey respondents will be sourced from an
9 222 existing Australian online panel, administered by PureProfile Pty Ltd. This panel is drawn from
10 223 volunteers (aged 18 and above and able to give consent) in the general population who are paid a small
11 224 amount by the panel administrators for completion of the survey. The advantage of this approach is that a
12 225 population can be drawn from the total available chosen based on pre-specified criteria such as age and
13 226 gender, thereby ensuring that a broadly representative population sample is obtained. Each respondent
14 227 will use a web link to access the survey, so is able to self-complete at their convenience.

19 228 The recruitment process is guided by Australia's NHMRC National Statement on Ethics Chapter 4.5⁵⁸.
20 229 The statement articulates the right of people with a cognitive impairment to participate in research and
21 230 outlines the considerations that need to be taken in this vulnerable population to ensure risks and burdens
22 231 are justified. A sample of dementia dyads will be recruited from Queensland, New South Wales and
23 232 South Australia from October 2017 to September 2018. A comprehensive recruitment approach will be
24 233 undertaken by contacting eligible participants through aged care providers, residential aged care facilities
25 234 and community centres in both metropolitan and regional areas. Purposeful sampling will be used with
26 235 quotas set (e.g. residential and community dwelling, gender, age) to ensure the generalisability of the
27 236 findings. Recruitment follows a two-step process. First, the primary caregiver is phoned by a member of
28 237 the research team after registration. A brief screening using set questions written for the study is used to
29 238 assess suitability for inclusion into the study. The process of participation is explained and the caregiver
30 239 is asked whether this is something that the PWD would be capable of and comfortable with. If during the
31 240 telephone conversation it is clear that the PWD has severe dementia or is unable to respond to questions,
32 241 or is likely to be distressed by an interview from an unfamiliar person, the person is excluded from
33 242 participation. If preliminary eligibility is determined, a face-to-face interview is booked and information
34 243 about the study is posted to the participants.

36 244 Second, the research assistant checks on arrival for interview that the participant information sheet has
37 245 been received and goes through this with the person and the carer, reminding them that participation is
38 246 voluntary and they can withdraw or stop at any time. Consent to participate is then obtained (the person
39 247 with dementia's consent is witnessed by the primary caregiver). Interviewers will be people with
40 248 experience in working with people with dementia and will have had additional training to be alert for
41 249 signs of distress and modify or discontinue the interview as appropriate.

53 250 **Pilot study**

1 251 Pilot studies will be conducted with a subset of 200 (of 2,000) from the general population sample and 25
2 252 (of 250) dementia dyads. The pilot aims to ascertain comprehension and understanding of the choice set
3 253 tasks, attributes and their levels as well as the functioning of the survey instrument. The pilot will
4 254 highlight any procedural issues for the experimental design of the survey and allow revisions if required.
5 255 The average time taken during the online survey pilot will be used to set a minimum time for respondents
6 256 to complete the main survey. Data from the pilot will be analysed to confirm the face validity of the
7 257 survey instrument.

8 258 A think-aloud technique will be used in the pilot interviews with the dementia dyads to gauge participant
9 259 understanding of the tasks and provide insight into the factors underlying the preferences of participants
10 260⁵⁹. By using the ‘think aloud’ approach during the pilot, we are asking respondents to explain their
11 261 thought process for making choices. If they repeatedly indicate they don’t understand, or if the
12 262 interviewer (who has experience working with people with dementia) deems they don’t understand,
13 263 transcripts and recordings of the interviews will be used by the research team, combined with GP-Cog
14 264 scores, to review the recruitment and interviewing process for the remaining dyads.

25 **Analytical plan**

26 266 We will use a multinomial (conditional) logistic (MNL) framework as outlined by McFadden⁶⁰ to
27 267 analyse both DCE_{TTO} and BWS responses. For both DCE_{TTO} and BWS, random effect utility functions
28 268 will be estimated following the Random Utility Theory’s argument that the utility value that an individual
29 269 attaches to an attribute in a choice scenario can be summarised by an explainable (fixed) component and
30 270 an unexplainable (random) component.

31 271 The specific utility function for the DCE_{TTO} responses will be modelled using the approach developed
32 272 and described by Bansback et al⁴⁶ due to its additional time duration attribute. The BWS-based utility
33 273 values will be estimated using a two-stage approach. In stage 1, the coefficients of a random effect utility
34 274 function will be estimated, from which the BWS values will be generated. These values will be anchored
35 275 onto the 1-0 full health-dead scale (required to generate QALYs) in stage 2 by mapping the modelled
36 276 values from a small selection of health states used for AD-5D (ranging from mild to severe impairment)
37 277 generated from the DCE_{TTO} study to the ordinal best-worst estimates to translate the best-worst estimates.
38 278 While this represents a new technique in this field, the process is equivalent to mapping from BWS to
39 279 utility values using TTO⁴⁷ or mapping from DCE to TTO⁴².

40 **Ethics and Dissemination**

41 281 This study has ethical approval from Griffith University HREC No 2016/626. A steering committee
42 282 consisting of researchers, consumers and aged care industry representatives will coordinate the project
43 283 and oversee any concerns arising from the conduct of the research. This committee will meet monthly for
44 284 the duration of the project.

45 285 This project will develop utility value sets for a new dementia-specific economic analysis tool, the AD-
46 286 5D. This will be the first dementia specific preference-based measure with an Australian value set. Once

1 287 developed, the AD-5D utility algorithms can be used to generate utility weights from any completion of
2 288 the QOL-AD instrument. The weights can be used to calculate QALYs for the economic evaluation of
3
4 289 treatments and interventions targeting people with dementia. This algorithm is applicable not only to
5
6 290 current and future clinical trials and intervention studies but also for previously collected data using the
7
8 291 QOL-AD, from which the AD-5D was derived.

9 292 Dissemination will occur through academic publications and conference presentations. Algorithms
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11 293 developed in the project will be available online. As well, the authors will record an online video
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13 294 demonstrating the use of the algorithms.

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For peer review only

1 296 **Footnotes**

2
3 297 **Contributors**

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5 298 TAC, KHN, JR, BM, DR conceived the study; TAC, KHN, JR, BM, DR, SK, MC, SL and WM
6 299 contributed to the design of the study, TAC, KHN, AW and LL wrote the manuscript. All authors have
7
8 300 read, contributed and approved the manuscript.

9
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18
19 307 **Competing interests statement**

20
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22
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314 **References**

- 315 1. Brazier, J. *Measuring and valuing health benefits for economic evaluation*. (Oxford
316 University Press, 2007).
- 317 2. Mulhern, B. *et al.* Development of DEMQOL-U and DEMQOL-PROXY-U: Generation of
318 preference-based indices from DEMQOL and DEMQOL-PROXY for use in economic
319 evaluation. *Health Technol. Assess.* **17**, 1–160 (2013).
- 320 3. Laakkonen, M.-L. *et al.* Effects of Self-Management Groups for People with Dementia and
321 Their Spouses—Randomized Controlled Trial. *J. Am. Geriatr. Soc.* **64**, 752–760 (2016).
- 322 4. Karttunen, K. *et al.* Neuropsychiatric symptoms and Quality of Life in patients with very
323 mild and mild Alzheimer’s disease. *Int. J. Geriatr. Psychiatry* **26**, 473–482 (2011).
- 324 5. Sintonen, H. An approach to measuring and valuing health states. *Soc. Sci. Med. [C]* **15**, 55–
325 65 (1981).
- 326 6. Hawthorne, G., Richardson, J. & Osborne, R. The Assessment of Quality of Life (AQoL)
327 instrument: a psychometric measure of Health-Related Quality of Life. *Qual. Life Res.* **8**,
328 209–224 (1999).
- 329 7. Nikmat, A. W., Hawthorne, G. & Al-Mashoor, S. H. The comparison of quality of life
330 among people with mild dementia in nursing home and home care—a preliminary report.
331 *Dementia* **14**, 114–125 (2015).
- 332 8. Wlodarczyk, J. H., Brodaty, H. & Hawthorne, G. The relationship between quality of life,
333 Mini-Mental State Examination, and the Instrumental Activities of Daily Living in patients
334 with Alzheimer’s disease. *Arch. Gerontol. Geriatr.* **39**, 25–33 (2004).
- 335 9. Wimo, A. *et al.* Cost-Utility Analysis of Group Living in Dementia Care. *International*
336 *Journal of Technology Assessment in Health Care* (1995). Available at:
337 /core/journals/international-journal-of-technology-assessment-in-health-
338 care/article/costutility-analysis-of-group-living-in-dementia-
339 care/78D0532F797AB8B81BCEE9D28EDB53AD. (Accessed: 16th April 2017)

- 1 340 10. Kerner, D. N., Patterson, T. L., Grant, I. & Kaplan, R. M. Validity of the Quality of Well-
2
3 341 Being Scale for Patients with Alzheimer's Disease. *J. Aging Health* **10**, 44–61 (1998).
4
5 342 11. Kaplan, R. M., Bush, J. W. & Berry, C. C. Health status: types of validity and the index of
6
7 343 well-being. *Health Serv. Res.* **11**, 478–507 (1976).
8
9 344 12. Furlong, W. J., Feeny, D. H., Torrance, G. W. & Barr, R. D. The Health Utilities Index
10
11 345 (HUI®) system for assessing health-related quality of life in clinical studies. *Ann. Med.* **33**,
12
13 346 375–384 (2001).
14
15 347 13. Mittmann, N., Trakas, K., Risebrough, N. & Liu, B. A. Utility Scores for Chronic
16
17 348 Conditions in a Community-Dwelling Population. *Pharmacoeconomics* **15**, 369–376 (1999).
18
19 349 14. Neumann, P. J. *et al.* Health Utilities in Alzheimer's Disease: A Cross-Sectional Study of
20
21 350 Patients and Caregivers. *Med. Care* **37**, 27–32 (1999).
22
23 351 15. EuroQol Group. EuroQol - a new facility for the measurement of health-related quality of
24
25 352 life. *Health Policy* **16**, 199–208 (1990).
26
27 353 16. Orgeta, V., Edwards, R. T., Hounsome, B., Orrell, M. & Woods, B. The use of the EQ-5D as
28
29 354 a measure of health-related quality of life in people with dementia and their carers. *Qual.*
30
31 355 *Life Res.* **24**, 315–324 (2015).
32
33 356 17. Aguirre, E., Kang, S., Hoare, Z., Edwards, R. T. & Orrell, M. How does the EQ-5D perform
34
35 357 when measuring quality of life in dementia against two other dementia-specific outcome
36
37 358 measures? *Qual. Life Res.* **25**, 45–49 (2016).
38
39 359 18. Mulhern, B. *et al.* Improving the Measurement of QALYs in Dementia: Developing Patient-
40
41 360 and Carer-Reported Health State Classification Systems Using Rasch Analysis. *Value*
42
43 361 *Health* **15**, 323–333 (2012).
44
45 362 19. Rowen, D. *et al.* Estimating Preference-Based Single Index Measures for Dementia Using
46
47 363 DEMQOL and DEMQOL-Proxy. *Value Health* **15**, 346–356 (2012).
48
49 364 20. Drummond, M., Sculpher, M. J., Claxton, K., Stoddart, G. L. & Torrance, G. W. *Methods*
50
51 365 *for the economic evaluation of health care programmes* . (Oxford University Press, 2015).
52
53
54
55
56
57
58
59
60

- 1 366 21. Hounsome, N., Orrell, M. & Edwards, R. T. EQ-5D as a Quality of Life Measure in People
2
3 367 with Dementia and Their Carers: Evidence and Key Issues. *Value Health* **14**, 390–399
4
5 368 (2011).
6
7 369 22. Neumann, P. J. Health utilities in Alzheimer’s disease and implications for cost-
8
9 370 effectiveness analysis. *Pharmacoeconomics* **23**, 537–541 (2005).
10
11 371 23. Arons, A. M. M., Schölzel-Dorenbos, C. J. M., Olde Rikkert, M. G. M. & Krabbe, P. F. M.
12
13 372 A Simple and Practical Index to Measure Dementia-Related Quality of Life. *Value Health*
14
15 373 **19**, 60–65 (2016).
16
17 374 24. Rowen, D. *et al.* Comparison of General Population, Patient, and Carer Utility Values for
18
19 375 Dementia Health States. *Med. Decis. Making* **35**, 68–80 (2015).
20
21 376 25. Nguyen, K.-H. *et al.* Developing a dementia-specific health state classification system for a
22
23 377 new preference-based instrument AD-5D. *Health Qual. Life Outcomes* **15**, 21 (2017).
24
25 378 26. Edelman, P., Fulton, B. R., Kuhn, D. & Chang, C.-H. A Comparison of Three Methods of
26
27 379 Measuring Dementia-Specific Quality of Life: Perspectives of Residents, Staff, and
28
29 380 Observers. *The Gerontologist* **45**, 27–36 (2005).
30
31 381 27. Logsdon, R. G., Gibbons, L. E., McCurry, S. M. & Teri, L. Quality of life in Alzheimer’s
32
33 382 disease: patient and caregiver reports. *J. Ment. Health Aging* **5**, 21–32 (1999).
34
35 383 28. Moniz-Cook, E. *et al.* A European consensus on outcome measures for psychosocial
36
37 384 intervention research in dementia care. *Aging Ment. Health* **12**, 14–29 (2008).
38
39 385 29. Von Neumann, J. *Theory of games and economic behavior*. (Princeton University Press,
40
41 386 2004).
42
43 387 30. Brazier, J., Roberts, J. & Deverill, M. The estimation of a preference-based measure of
44
45 388 health from the SF-36. *J. Health Econ.* **21**, 271–292 (2002).
46
47 389 31. Torrance, G. W., Thomas, W. H. & Sackett, D. L. A Utility Maximization Model for
48
49 390 Evaluation of Health Care Programs. *Health Serv. Res.* **7**, 118–133 (1972).
50
51
52
53
54
55
56
57
58
59
60

- 1 391 32. Dolan, P., Gudex, C., Kind, P. & Williams, A. The time trade-off method: Results from a
2
3 392 general population study. *Health Econ.* **5**, 141–154 (1996).
4
5 393 33. Kim, S.-H. *et al.* The EQ-5D-5L valuation study in Korea. *Qual. Life Res.* **25**, 1845–1852
6
7 394 (2016).
8
9 395 34. Ratcliffe, J., Brazier, J., Tsuchiya, A., Symonds, T. & Brown, M. Using DCE and ranking
10
11 396 data to estimate cardinal values for health states for deriving a preference-based single index
12
13 397 from the sexual quality of life questionnaire. *Health Econ.* **18**, 1261–1276 (2009).
14
15 398 35. Propper, C. Contingent Valuation of Time Spent on NHS Waiting Lists. *Econ. J.* **100**, 193–
16
17 399 199 (1990).
18
19 400 36. Coast, J. *et al.* Valuing the ICECAP capability index for older people. *Soc. Sci. Med.* **67**,
20
21 401 874–882 (2008).
22
23 402 37. Ratcliffe, J. *et al.* Valuing the Child Health Utility 9D: Using profile case best worst scaling
24
25 403 methods to develop a new adolescent specific scoring algorithm. *Soc. Sci. Med.* **157**, 48–59
26
27 404 (2016).
28
29 405 38. Louviere, J. J. & Woodworth, G. G. Best-worst scaling: A model for the largest difference
30
31 406 judgments. *Univ. Alta. Work. Pap.* (1991).
32
33 407 39. Keeney, R. L. & Winterfeldt, D. von. A Prescriptive Risk Framework for Individual Health
34
35 408 and Safety Decisions. *Risk Anal.* **11**, 523–533 (1991).
36
37 409 40. Ali, S. & Ronaldson, S. Ordinal preference elicitation methods in health economics and
38
39 410 health services research: using discrete choice experiments and ranking methods. *Br. Med.*
40
41 411 *Bull.* **103**, 21–44 (2012).
42
43 412 41. Bleichrodt, H. A new explanation for the difference between time trade-off utilities and
44
45 413 standard gamble utilities. *Health Econ.* **11**, 447–456 (2002).
46
47 414 42. Rowen, D., Brazier, J. & Van Hout, B. A Comparison of Methods for Converting DCE
48
49 415 Values onto the Full Health-Dead QALY Scale. *Med. Decis. Making* **35**, 328–340 (2015).
50
51
52
53
54
55
56
57
58
59
60

- 1 416 43. Robinson, A., Spencer, A. & Moffatt, P. A Framework for Estimating Health State Utility
2
3 417 Values within a Discrete Choice Experiment: Modeling Risky Choices. *Med. Decis. Making*
4
5 418 **35**, 341–350 (2015).
6
7 419 44. Oppe, M., Devlin, N. J., van Hout, B., Krabbe, P. F. M. & de Charro, F. A Program of
8
9 420 Methodological Research to Arrive at the New International EQ-5D-5L Valuation Protocol.
10
11 421 *Value Health* **17**, 445–453 (2014).
12
13 422 45. Norman, R. *et al.* Does mode of administration matter? Comparison of online and face-to-
14
15 423 face administration of a time trade-off task. *Qual. Life Res.* **19**, 499–508 (2010).
16
17 424 46. Bansback, N., Brazier, J., Tsuchiya, A. & Anis, A. Using a discrete choice experiment to
18
19 425 estimate health state utility values. *J. Health Econ.* **31**, 306–318 (2012).
20
21 426 47. Netten, A. *et al.* Outcomes of social care for adults: developing a preference-weighted
22
23 427 measure. *Health Technol. Assess. Winch. Engl.* **16**, 1–166 (2012).
24
25 428 48. Flynn, T. N. Valuing citizen and patient preferences in health: recent developments in three
26
27 429 types of best–worst scaling. *Expert Rev. Pharmacoecon. Outcomes Res.* **10**, 259–267 (2010).
28
29 430 49. Flynn, T. N., Louviere, J. J., Peters, T. J. & Coast, J. Best–worst scaling: What it can do for
30
31 431 health care research and how to do it. *J. Health Econ.* **26**, 171–189 (2007).
32
33 432 50. Flynn, T. & Marley, A. Best-worst scaling: theory and methods. (Edward Elgar, 2014).
34
35 433 51. Metrics, C. Ngene 1.1. 2. *User Man. Ref. Guide* (2014).
36
37 434 52. Milte, R. *et al.* Cognitive Overload? An Exploration of the Potential Impact of Cognitive
38
39 435 Functioning in Discrete Choice Experiments with Older People in Health Care. *Value Health*
40
41 436 **17**, 655–659 (2014).
42
43 437 53. Reed Johnson, F. *et al.* Constructing Experimental Designs for Discrete-Choice
44
45 438 Experiments: Report of the ISPOR Conjoint Analysis Experimental Design Good Research
46
47 439 Practices Task Force. *Value Health* **16**, 3–13 (2013).
48
49 440 54. Stamuli, E. Health outcomes in economic evaluation: who should value health? *Br. Med.*
50
51 441 *Bull.* **97**, 197–210 (2011).
52
53
54
55
56
57
58
59

- 1 442 55. Peeters, Y., Vliet Vlieland, T. P. M. & Stiggelbout, A. M. Focusing illusion, adaptation and
2
3 443 EQ-5D health state descriptions: the difference between patients and public. *Health Expect.*
4
5 444 **15**, 367–378 (2012).
6
7 445 56. Brodaty, H., Kemp, N. M. & Low, L.-F. Characteristics of the GPCOG, a screening tool for
8
9 446 cognitive impairment. *Int. J. Geriatr. Psychiatry* **19**, 870–874 (2004).
10
11 447 57. Milte, R. *et al.* Cognitive overload? An exploration of the potential impact of cognitive
12
13 448 functioning in discrete choice experiments with older people in health care. *Value Health J.*
14
15 449 *Int. Soc. Pharmacoeconomics Outcomes Res.* **17**, 655–659 (2014).
16
17 450 58. Council, N. H. and M. R. National Statement on Ethical Conduct in Human Research (2007)
18
19 451 (Updated May 2015) | National Health and Medical Research Council. (2011). Available at:
20
21 452 <https://www.nhmrc.gov.au/book/national-statement-ethical-conduct-human-research>.
22
23 453 (Accessed: 10th November 2017)
24
25 454 59. Whitty, J. A., Walker, R., Golenko, X. & Ratcliffe, J. A Think Aloud Study Comparing the
26
27 455 Validity and Acceptability of Discrete Choice and Best Worst Scaling Methods. *PLOS ONE*
28
29 456 **9**, e90635 (2014).
30
31 457 60. McFadden, D. Conditional logit analysis of qualitative choice behavior. (1973).
32
33
34
35
36 458

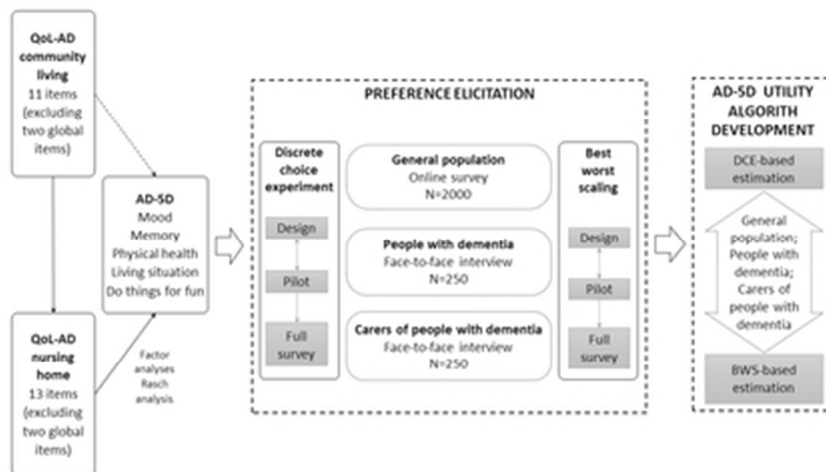


Figure 1: Process and methodology of the AD-5D project

36x20mm (300 x 300 DPI)