Adaptive tests for long-term conditions

Supporting patient-centred care for patients with long term conditions

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Background

- Multimorbidity.
- Undetected psychosocial issues.
- Assessment using PROMs increases involvement.
- PROMs suffer from barriers to implementation.
- Computer adaptive testing (CAT) may help overcome barriers to the implementation of PROMs in primary care.

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Background

Qual Life Res (2008) 17:179–193
DOI 10.1007/s11136-007-9295-0

The impact of measuring patient-reported outcomes in clinical practice: a systematic review of the literature

J. M. Valderas · A. Kotzeva · M. Espallargues · G. Guyatt · C. E. Ferrans · M. Y. Halyard · D. A. Revicki · T. Symonds · A. Parada · J. Alonso

- 28 Studies reviewed
- 50% of studies in mental health
- Compared PROM use with feedback to no feedback

- 67% of studies showed impact on processes
- 47% of studies showed impact on outcomes

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Background

Routine use of patient reported outcome measures (PROMs) for improving treatment of common mental health disorders in adults (Review)

Kendrick T, El-Gohary M, Stuart B, Gilbody S, Churchill R, Aiken L, Bhattacharya A, Gimson A, Brütt AL, de Jong K, Moore M

- 17 studies
- No evidence for improvement in symptoms
- High risk of bias
- Short follow-up

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Background

Using Feedback From Patient-Reported Outcome Measures in Mental Health Services: A Scoping Study and Typology

Christian U. Krägeloh, Ph.D., Karol J. Czuba, M.Phty., D. Rex Billington, Ph.D., Paula Kersten, Ph.D., Richard J. Siegert, Ph.D.

- Studies with formalised feedback *did* show a significant effect of clinical PROM use.
- Feedback should be given in a formalised and structured manner.

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Background

THE COCHRANE COLLABORATION®

Routine provision of information on patient-reported outcome measures to healthcare providers and patients in clinical practice (Protocol)

Gonçalves Bradley DC, Gibbons C, Ricci-Cabello I, Bobrovitz NJH, Gibbons EJ, Kotzeva A, Alonso J, Fitzpatrick R, Bower P, van der Wees PJ, Rajmil L, Roberts NW, Taylor RS, Greenhalgh J, Porter I, Valderas JM

Updated review due 2017

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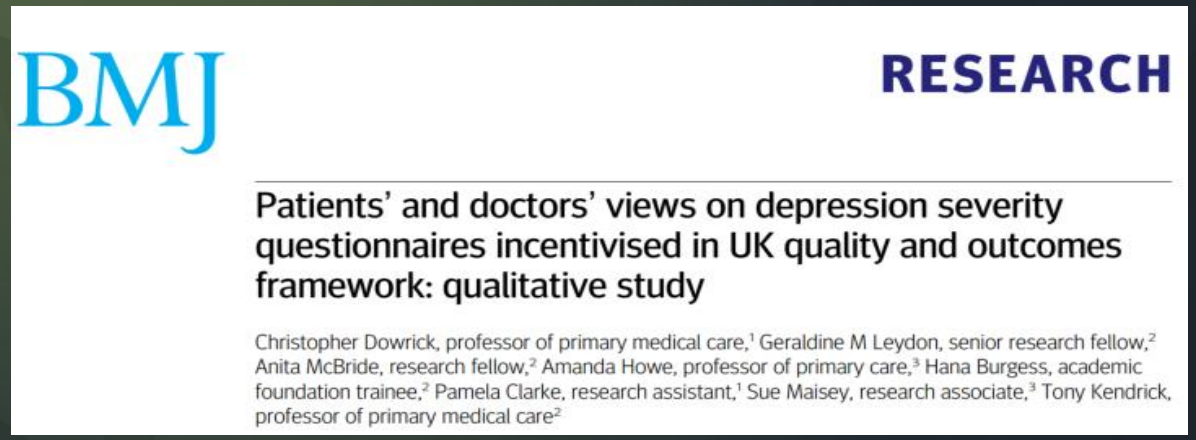
What do patients think?

- PROMS for Depression in primary care in the UK.
- Patients favoured the PROMS.
- They saw them as an efficient and structured supplement to medical judgement.
- They saw them as evidence that clinicians were taking their problems seriously through full assessment.



BMJ

RESEARCH

Patients' and doctors' views on depression severity questionnaires incentivised in UK quality and outcomes framework: qualitative study

Christopher Dowrick, professor of primary medical care,[1] Geraldine M Leydon, senior research fellow,[2] Anita McBride, research fellow,[2] Amanda Howe, professor of primary care,[3] Hana Burgess, academic foundation trainee,[2] Pamela Clarke, research assistant,[1] Sue Maisey, research associate,[3] Tony Kendrick, professor of primary medical care[2]

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What seems to work

- Specific PROM training
- Frequent and timely feedback
- Feedback processes well aligned with practice
- Information integrated into available systems
- Information that is linked to specific clinical action

- Interventions with a formal, structured, feedback process perform better (Krageloh, 2014).

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But…

Implementation rates are

LOW

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Overcome barriers

- Make measurement more accurate
- Make measurement more efficient
- Engage patients and clinicians with instant feedback
- Align feedback more closely with care

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Computer adaptive testing

Computer system which uses algorithms to match participants with the most relevant questions for them.

Assessments which use IRT and CAT are shorter, better targeted, and thus more reliable than paper-based tests.

JCE
JOURNAL OF CLINICAL EPIDEMIOLOGY

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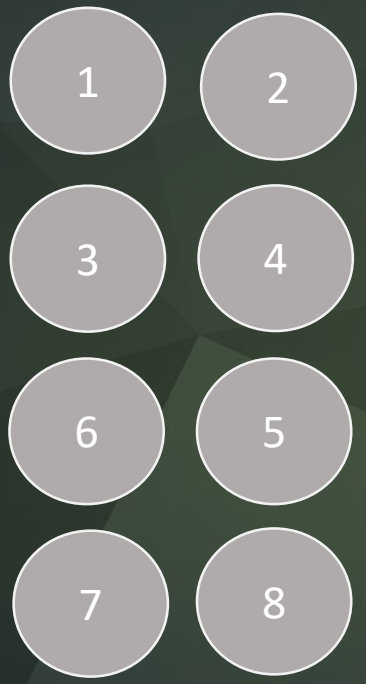
Computer adaptive testing_

Item bank



Computer adaptive test

Patient/ participant

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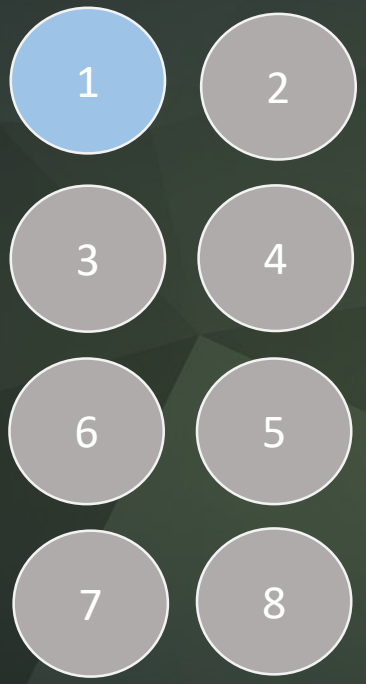
Computer adaptive testing_

Item bank



Computer adaptive test

Patient/ participant

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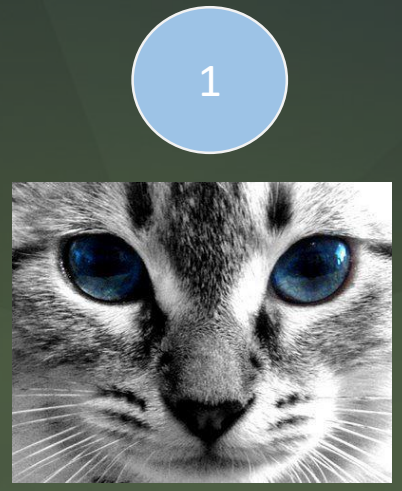
Computer adaptive testing_

Item bank

Computer adaptive test



Patient/ participant

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Computer adaptive testing_

Item bank

Computer adaptive test

Item

Patient/ participant

1

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Computer adaptive testing_

Item bank

Computer adaptive test

Response

Patient/ participant

1

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Computer adaptive testing_

Item bank

2
3
4
6
5
7
8

Computer adaptive test

$$P_{ni} = \frac{e^{(\theta_n - bi)}}{1 + e^{(\theta_n - bi)}}$$

Response

Patient/ participant

1

Quality of life estimate = 20

Reliability .70 .80 .90

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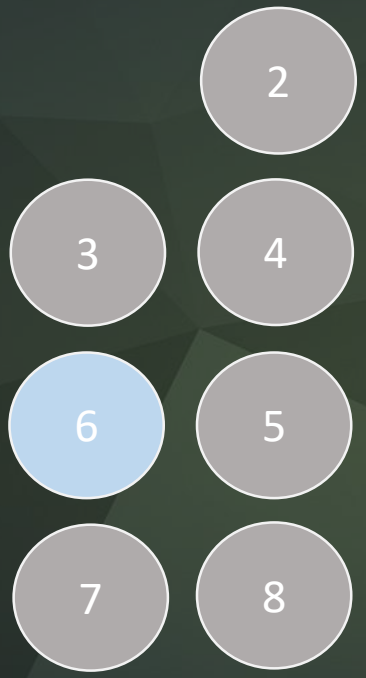
Computer adaptive testing_

Item bank

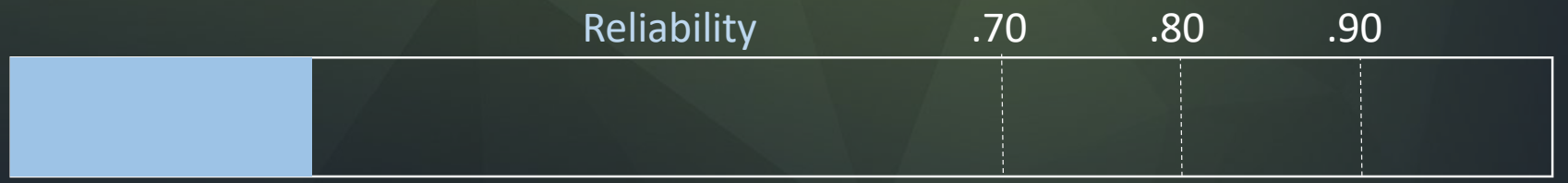


Computer adaptive test

Patient/ participant

1

Quality of life estimate = 20



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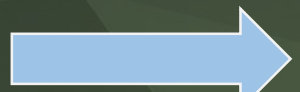
Computer adaptive testing_

Item bank

Computer adaptive test

Patient/ participant



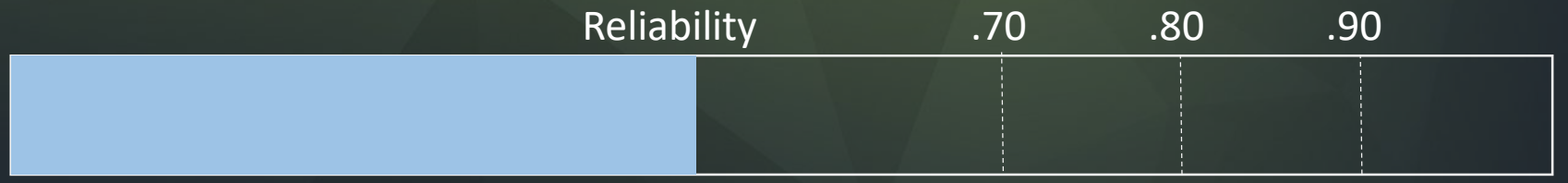
Item

Response

1

6

Quality of life estimate = 50



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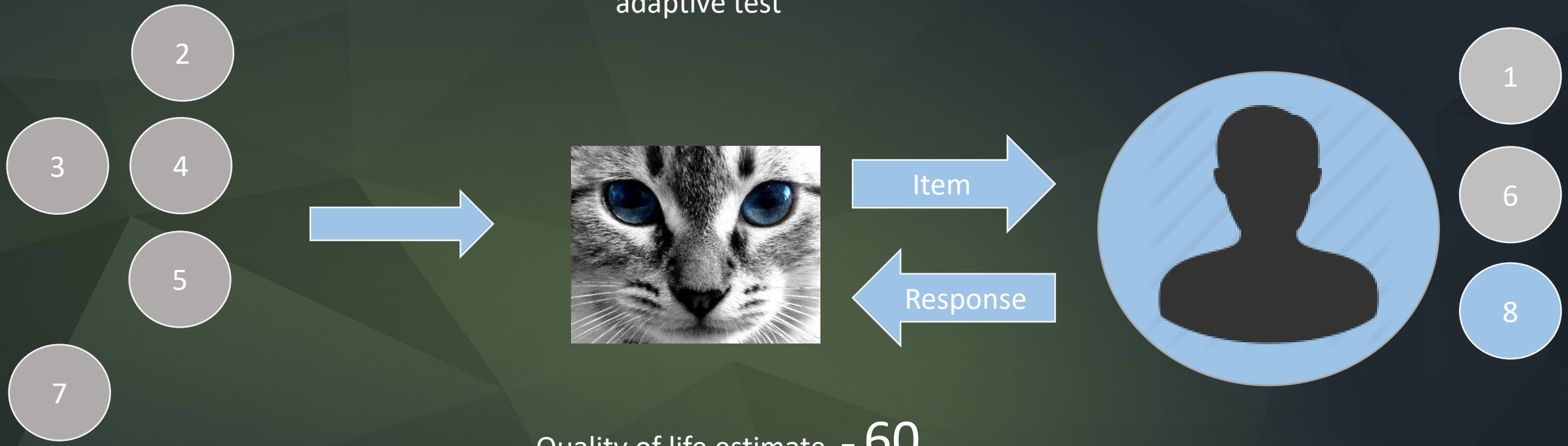
Computer adaptive testing_

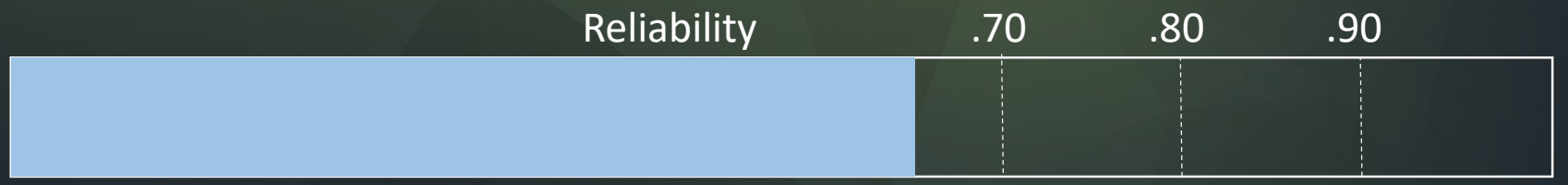
Item bank

Computer adaptive test

Patient/ participant



Quality of life estimate = 60



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Computer adaptive testing_

Item bank

Computer adaptive test

Patient/ participant

2

3

5

7

Item

Response

1

6

8

4

Quality of life estimate = 55

Reliability .70 .80 .90

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adaptive tests

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WHOQOL adaptive test

- Physical, psychological, social, and environmental QoL.
- 4000 people (320 from the UK).
- Partial credit model parameters, no DIF for UK sample or between conditions, all assumptions of the model met.
- Simulated CAT using 1000 iterations based on experimental theta values.
- Stopping rules related to standard error of .32, .45, and .55 (Reliability .90,.80 and .70) and matched reliability of paper WHO measures.

JMIR Publications
The Leading eHealth Publisher

Gibbons, *et el.* (2016). Electronic quality of life assessment using computer-adaptive testing. JMIR. 18(9):e240

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WHOQOL adaptive test

reliability **.90**

9 Items

reliability **.80**

4 Items

reliability **.70**

2 Items

82% shorter than **WHOQOL-100**

46% shorter than **WHOQOL-BREF**

JMIR Publications
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Gibbons, *et el.* (2016). Electronic quality of life assessment using computer-adaptive testing. JMIR. 18(9):e240

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Concerto

CONCERTO

Adaptive Quality of Life

Over the past two weeks...

Do you have enough energy for everyday life?

Not at all	A little	Moderately	Mostly	Completely
○	○	○	○	○

Next

Items copyright the World Health Organisation
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Personalised Quality of Life (QoL) feedback

Unique Identifier - S5QHJ

Scale	Score
Physical QoL	60
Psychological QoL	71
Social QoL	53
Environmental QoL	76

The scores above are worked out from the answers that you gave to the questions you have just completed. Your results are given on the chart above. A higher score means that you have a higher quality of life. The table below gives you a little bit more information about what each of the scores mean.

Physical Quality of Life

Your physical quality of life includes things like how well you are able to move around, how much energy you have or how much you are in pain.

Your score of 60 on this scale indicates that your physical quality of life is normal. The majority of people in the United Kingdom report a similar quality of life to you.

If you are worried about your physical quality of life then you should contact your doctor. You can click here to find a local doctor or click here to access local emergency services

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Sample

1238 participants

97 countries

311 UK

70 chronic conditions

45 years old

56% male

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WHOQOL adaptive test

Entire assessment takes

Two minutes

up to 10 minutes shorter than the WHOQOL-100

JMIR Publications
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Gibbons, *et el.* (2016). Electronic quality of life assessment using computer-adaptive testing. JMIR. 18(9):e240

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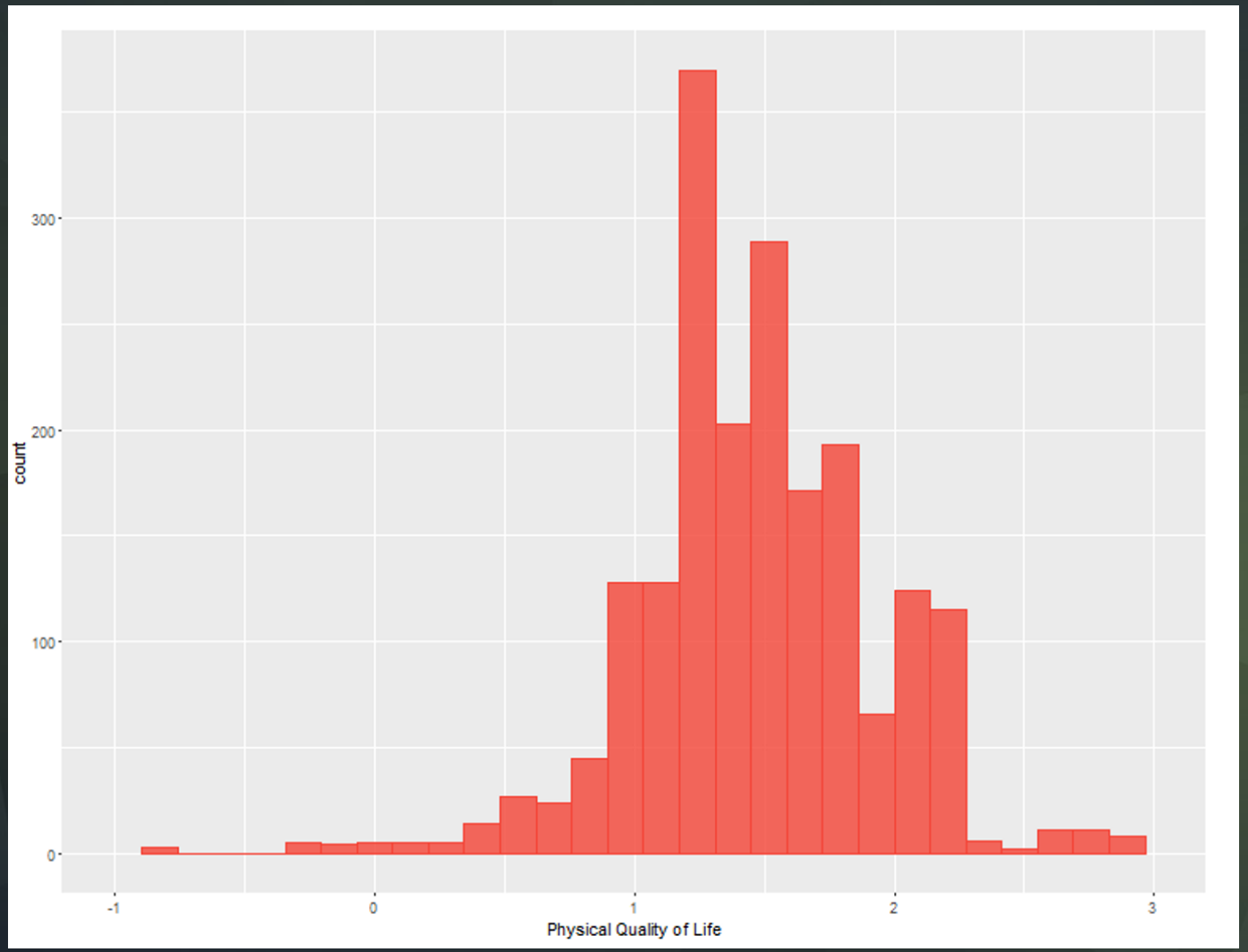
Physical QoL



Items 4.83

Mean score 65.7

SD 10

MID 5

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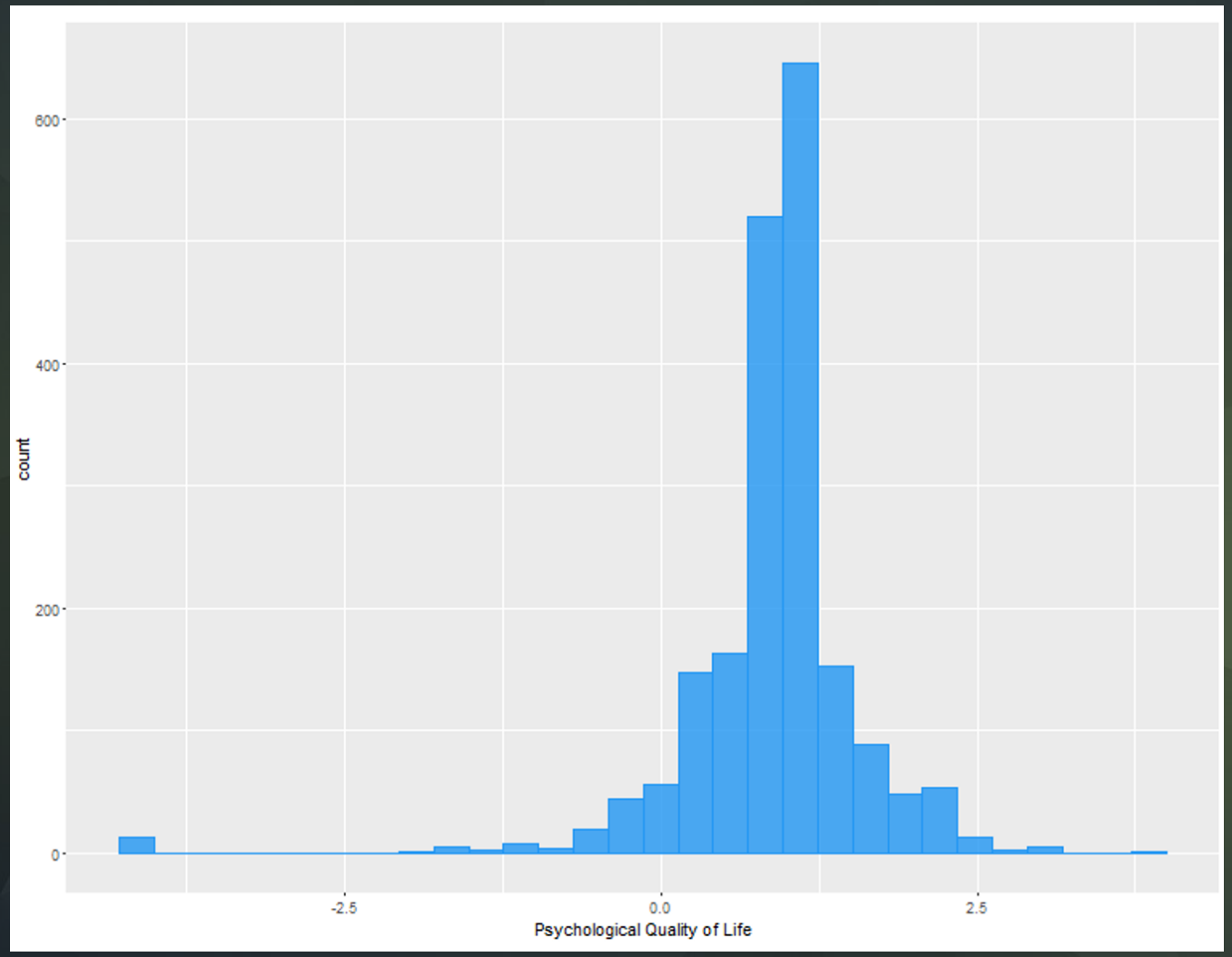
Psychological QoL



Items 5.34

Mean 61.5

SD 10

MID 5

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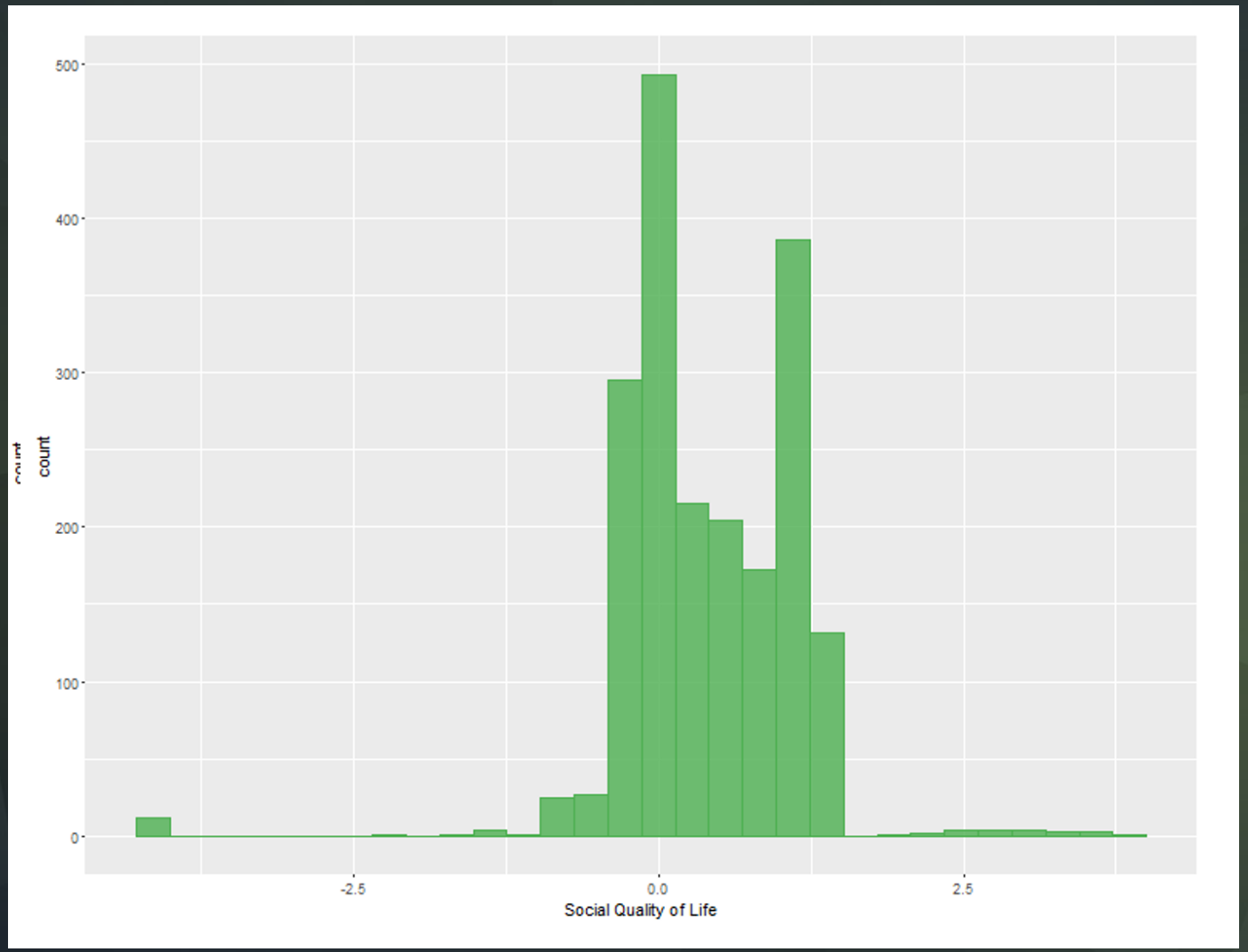
Social QoL



Items 4.77

Mean 59.3

SD 10

MID 5

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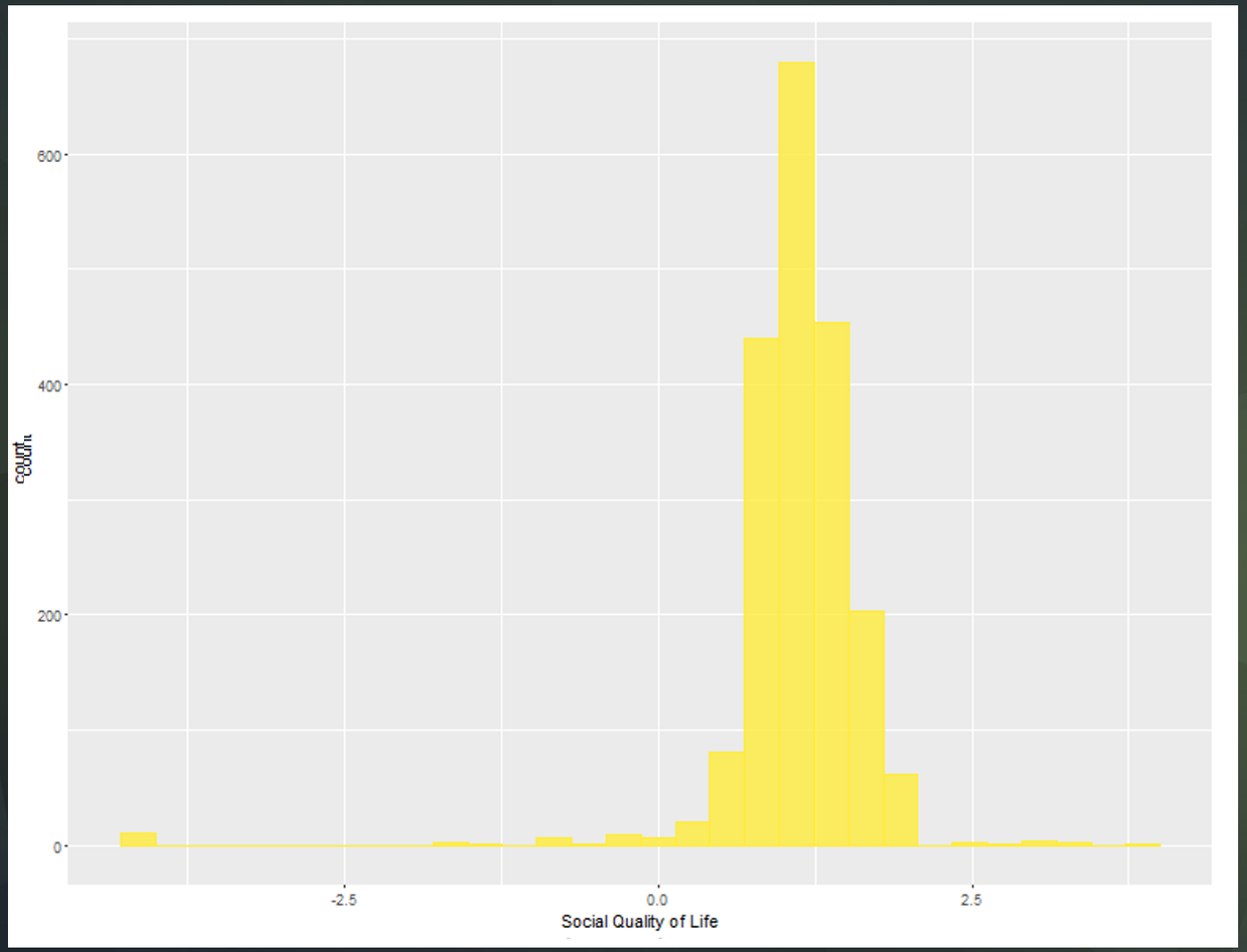
Environmental QoL



Items 4.59

Mean 53.8

SD 10

MID 5

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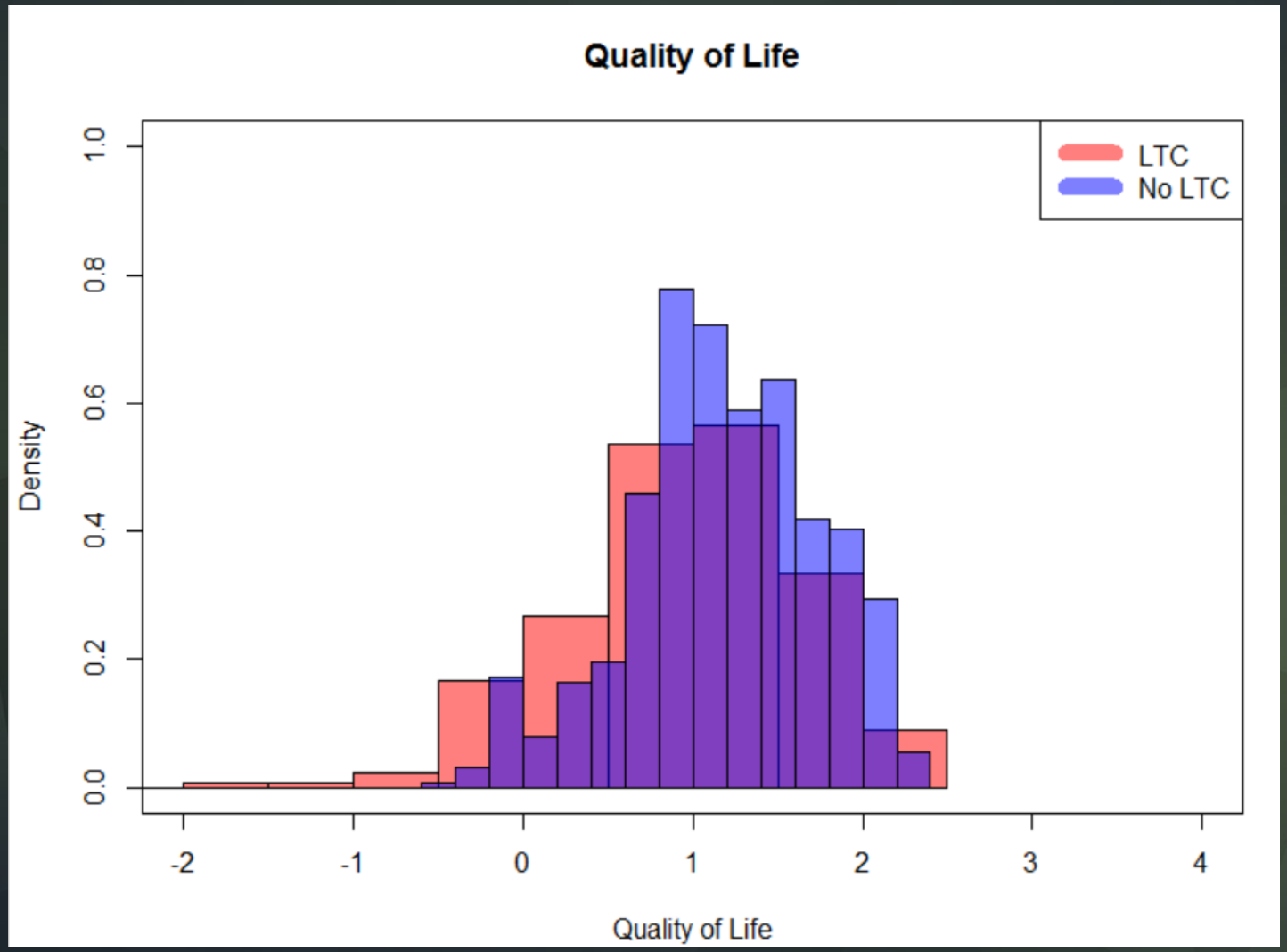
WHOQOL adaptive test



- Significant differences between QoL for patients with long-term conditions (LTCs) and without (P<.01) in all domains
- Differences were greater than the minimally clinically important difference (SD/2)

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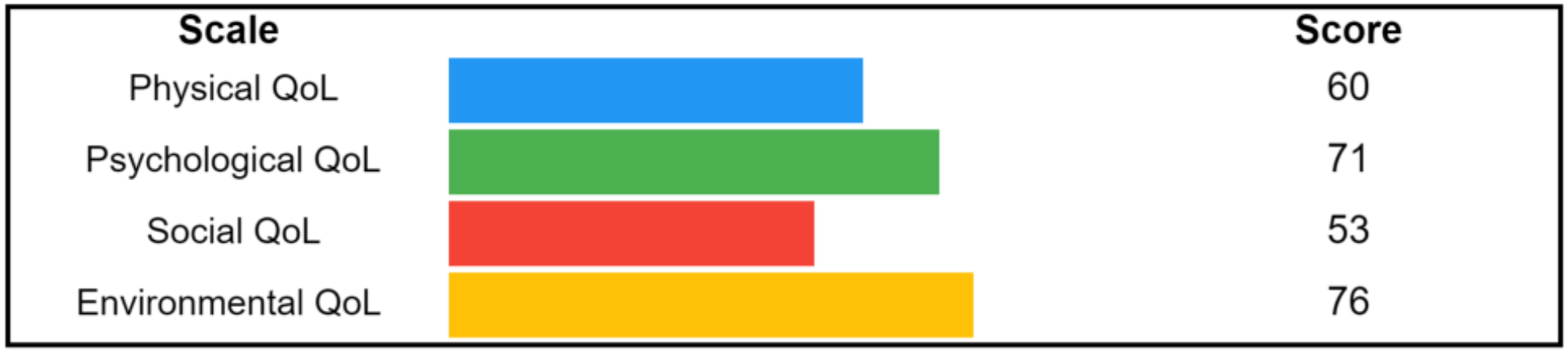
Graphical feedback

Personalised Quality of Life (QoL) feedback

Unique Identifier - S5QHJ



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Text feedback

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Future work

Limit the loss of information from a CAT.

Include open-text feedback and machine learning.

Include individualised information.

Clinician-facing feedback.

Generalise the system to other measures.

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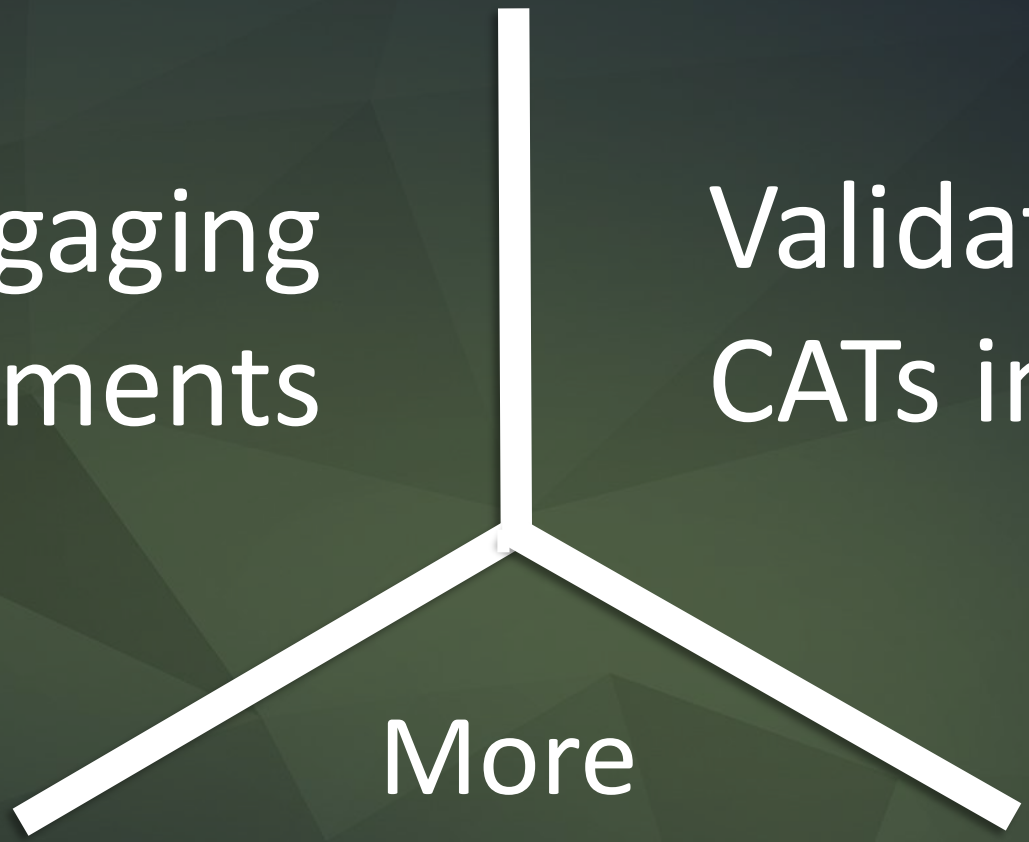
CAT Predictions



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Thank you

@drcgibbons
@campsych
@cam_concerto

Source code and slides:
github.com/chrisgibbons