Using computer adaptive testing to assess quality of life in cancer clinical trials

Brendan Mulhern, Carrie-Anne Ng, Tim Luckett
Cancer Quality of Life Expert Service Team (CQUEST), University of Technology Sydney (UTS)

What is computer adaptive testing (CAT)?

- CAT concerns the development of **'tailored'** or adaptive tests via a large item bank of calibrated questions.
- When a patient is being assessed by CAT, their responses to previous items inform the selection of the most informative next item. This process continues until a **precise estimate** of the scale score is reached.

Why should I use CAT in my clinical trial?

Quality of life (QoL) is typically assessed by patient-reported outcome measures (PROMs). For example, the EORTC QLQ-C30 and FACT-G are commonly used in cancer clinical trials.

However, fixed-form PROMs can increase **respondent burden** as they may include items of limited relevance for an individual patient.

Instead, **CAT questionnaires are typically 30-50% shorter than traditional PROMs at no expense of measurement precision** (1).

Item banks

CAT questions are drawn from **item banks**, which are a collection of pre-tested and calibrated items to measure a factor (e.g. physical function) that influences QoL.

Patient Reported Outcome Measurement System (**PROMIS**) provides over 300 CAT item banks, including five cancer-specific measures (anxiety/ fear; depression/sadness; fatigue; pain; and physical function).

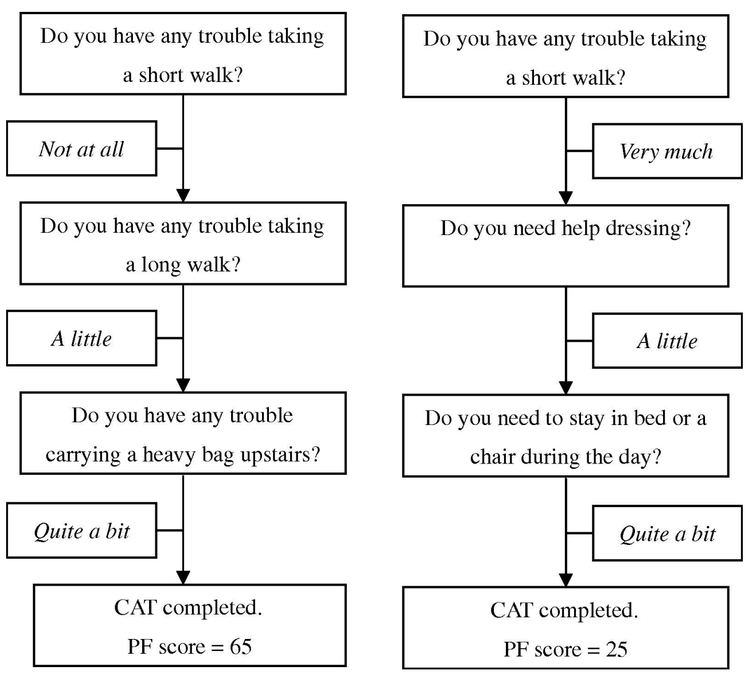
The **EORTC CAT** is consists of 14 item banks for the function and symptom-related domains in the EORTC QLQ-C30 plus global QoL items.

How are questions chosen in a CAT?

The general principle is that:

- if a patient reported few problems or issues on the previous items, the next item will concern a more demanding or difficult task.
- if severe problems were previously reported, the next item will concern a less difficult task.

Two examples of how the EORTC CAT measurement of physical functioning could proceed (2)



This helps to pinpoint the respondent's exact location on the ability continuum.

Item difficulty levels are factored into the **item-response theory (IRT) model** of the CAT.

Advantages

- CAT can minimise respondent burden
- Avoids overestimating or underestimating patients' health status and therefore floor and ceiling effects
- Can pre-specify degree of precision to be achieved or number of items before test is terminated

Disadvantages

- Item banks must be rigorously tested
- Potential practical difficulties in its implementation in hospitals and similar settings (e.g. only can be used on certain software)
- Knowledge requirements to implement, analyse and interpret.

Try a quick demo of a CAT (developed by PROMIS)

If you are interested in setting up a CAT in your clinical trial, please contact cquest@uts.edu.au for more information.

UTS Cancer Quality of Life Expert Service Team (CQUEST)

References:
1. Wainer H, Dorans NJ, Flaugher R, Green BF, Mislevy RJ. Computerized adaptive testing: A primer: Routledge; 2000.
2. Petersen MA, Groenvold M, Aaronson NK, Chie W-C, Conroy T, Costantini A, et al. Development of computerised adaptive testing (CAT) for the EORTC QLQ-C30 dimensions – General approach and initial results for physical functioning. Eur J Cancer. 2010;46(8):1352-8.