How is Quality of Life Measured for Health Technology Assessments?
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1 What is CEA and what are QALYs?

Cost-effectiveness analyses (CEAs) compare the relative costs and outcomes of different health treatments. The outcomes in a conventional CEA are usually described using the QALY, which is a composite measure that combines morbidity and mortality, such that that one QALY is of equivalent value to a year in full health (Brazier et al., 2016). The QOL component of the QALY requires health state utilities, which are anchored at 1 (indicating full health) and 0 (indicating being dead).

Figure 1 illustrates how the utilities are used to calculate QALYs. Imagine an individual has a chronic health condition which means that they will live to age 60 and experience an average QOL (or health state utility) of 0.7. This individual will achieve 42 QALYs over their lifetime. In contrast, imagine another individual that has no underlying chronic health conditions and will live to age 80 whilst experiencing full health throughout. This individual will achieve 80 QALYs over their lifetime.

**FIGURE 1: QUALITY-ADJUSTED LIFE YEARS**

Treatments can increase survival or QOL (or both), and data on both are required for calculating QALY gains. Survival data typically come from models based on extrapolations from clinical trial observations. QOL data typically come from validated measures designed to provide quality of life assessments that are completed by patients (or proxies) at several time points before, during, and after experiencing the treatment.
2 What are QOL measures and how do they provide health state utilities?

QOL measures — a type of patient-reported outcome measure — are questionnaires that ask about the patient’s health-related quality of life. The type of questions included in the measure depends on the type of measure. Broadly, there are two types: generic and condition-specific. Generic measures aim to provide an overall picture of the patient’s QOL and may be applied across all health conditions. In contrast, condition-specific measures focus more specifically on the health condition that the patient is experiencing.

Some QOL measures are preference-based, which means that they have an accompanying value set (also referred to as a utility tariff), typically derived from the preferences of the general population. Value sets enable the conversion of every possible response to the questionnaire into a single health state utility (or value). If patients complete the preference-based measure before, during, and after a treatment, then the change in utility can be estimated and used in QALY calculations.

<table>
<thead>
<tr>
<th>BOX 1: EXAMPLES OF DIFFERENT QOL MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GENERIC</strong></td>
</tr>
<tr>
<td><strong>PREFERENCE-BASED</strong></td>
</tr>
<tr>
<td><strong>NON-PREFERENCE-BASED</strong></td>
</tr>
</tbody>
</table>

*Designed specifically for use in younger populations.

There are a wide range of QOL measures, as illustrated in Box 1. HTA agencies such as the National Institute for Health and Care Excellence (NICE) in the United Kingdom and the Institute for Clinical and Economic Review (ICER) in the United States generally recommend that generic, preference-based measures are used to generate QALYs for CEAs, with a specific recommendation for EQ-5D (NICE, 2013; ICER, 2018).

In summary, the predominant approach for measuring QOL is to use a generic preference-based measure (e.g., EQ-5D), which is a questionnaire that is completed by patients. Each response to EQ-5D has an associated utility, which are typically derived from the preferences of the general population in the country of relevance. Utilities provide the information on QOL, which together with information on survival gains or life expectancy is used to calculate QALYs.
3 What is EQ-5D and what are the advantages and disadvantages of using it?

EQ-5D contains five broad questions about health as indicated in Box 2 (Devlin and Brooks, 2017).

**BOX 2: SUMMARY OF THE EQ-5D**

<table>
<thead>
<tr>
<th>THE DIMENSIONS</th>
<th>THE RESPONSE LEVELS</th>
<th>OBTAINING UTILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The five dimensions of the EQ-5D:</td>
<td>For the five-level version of EQ-5D, the person indicates for each dimension, whether they have:</td>
<td>Value sets are available for many countries, which are based on general population preferences (this is what makes EQ-5D preference-based). This means that responses to the EQ-5D can be translated into a health state utility.</td>
</tr>
<tr>
<td>• Mobility (walking about)</td>
<td>• No problems</td>
<td></td>
</tr>
<tr>
<td>• Self-care (washing or dressing oneself)</td>
<td>• Slight problems*</td>
<td></td>
</tr>
<tr>
<td>• Usual activities</td>
<td>• Moderate problems</td>
<td></td>
</tr>
<tr>
<td>• Pain/discomfort</td>
<td>• Severe problems*</td>
<td></td>
</tr>
<tr>
<td>• Anxiety/depression</td>
<td>• Unable to / extreme problems</td>
<td></td>
</tr>
</tbody>
</table>

*These levels are not included in the three-level version

Several HTA agencies worldwide recommend the use of the EQ-5D (Rowen et al., 2017a). As a short, generic questionnaire, it is low burden to patients and can be readily applied in a wide range of health settings. The latter is appealing to decision makers that make funding decisions or recommendations in systems facing limited resources, as it enables treatments for different health conditions to be assessed using the same metrics. Furthermore, studies have indicated that EQ-5D is responsive to changes in health in several different contexts, such as diabetes, skin diseases, urinary incontinence, chronic obstructive pulmonary disease, and asthma (Finch, Brazier and Mukuria, 2018).

However, it also has its disadvantages, particularly when the key objective is to assess a treatment in relation to outcomes that are important to specific patient groups. The EQ-5D was not designed with involvement from patients and, as it contains only five questions, is unlikely to adequately cover the full range of outcomes that are of importance to patients with different conditions. The generic nature of the EQ-5D can also mean that it is not responsive to changes in health in all contexts. For example, vision, energy, cognition, and hearing are not directly captured within the EQ-5D. Finally, it has been found that EQ-5D does not perform well, for different reasons, in some conditions such as multiple sclerosis, personality disorders, schizophrenia, and dementia, and has mixed results in visual disorders and some cancers (Finch, Brazier and Mukuria, 2018).
What are the other dimensions of QOL and how can they be captured?

EQ-5D captures five specific dimensions of QOL. A number of additional dimensions can be relevant to patients, as illustrated visually in Figure 2. The outer circle represents the concept of wellbeing, which is broader than QOL and therefore encompasses it. Each white oval represents an individual dimension of QOL or wellbeing. The five dimensions from EQ-5D are in the inner dotted circle; those in the middle circle represent QOL dimensions that are not captured by EQ-5D and include, for example, cognition and fatigue.

**FIGURE 2: DIMENSIONS OF WELLBEING AND HEALTH-RELATED QUALITY OF LIFE**

Note: this figure does not capture all the dimensions of QOL and wellbeing that have been identified in the literature.
5 How can alternatives to EQ-5D fill the gaps?

Consider Figure 2, where the dotted inner circle represents EQ-5D. Moving the dotted circle to capture a different selection of dimensions represents an alternative generic measure to EQ-5D (Brazier et al., 2017). The selection may solely contain dimensions of QOL (e.g., SF-6D) or it could contain dimensions of wellbeing (e.g., ICECAP-A). It is also possible to have a measure that combines aspects of both QOL and wellbeing (e.g., EQ-HWB; currently under development). Expanding the dotted circle to include one (or potentially more) additional dimensions represents a bolt-on (or bolt-ons) for the EQ-5D (Finch, Brazier and Mukuria, 2019). Focusing the scope more specifically on QOL dimensions relevant to a particular patient group would represent a condition-specific measure. In practice, there are many different measures available, which include different dimensions. However, only preference-based measures, i.e., those with accompanying value sets (as described in Box 1), facilitate the estimation of utilities for QALY calculations (Rowen et al., 2017b).

When QOL data has not been collected using preference-based measures, it may be possible to use a mapping algorithm to predict utilities based on patients’ responses to non-preference-based measures (Mukuria et al., 2019).

Much like the EQ-5D itself, each of these alternatives have advantages and disadvantages, as summarised in Box 3.

<table>
<thead>
<tr>
<th>BOX 3: ADVANTAGES AND DISADVANTAGES OF EQ-5D ALTERNATIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADVANTAGES</strong></td>
</tr>
<tr>
<td>ALTERNATIVE GENERIC PREFERENCE-BASED MEASURES</td>
</tr>
<tr>
<td>• It is unlikely that a single alternative measure will outperform EQ-5D in all contexts • No generic measure is likely to capture all outcomes that are of importance to patients</td>
</tr>
<tr>
<td>BOLT-ON QUESTIONS FOR EQ-5D</td>
</tr>
<tr>
<td>• Bolt-ons are under development and there are currently no official bolt-ons or accompanying value sets • Including bolt-on questions on an ad-hoc basis will reduce comparability between CEAs</td>
</tr>
<tr>
<td>CONDITION-SPECIFIC PREFERENCE-BASED MEASURES</td>
</tr>
<tr>
<td>• These measures focus on specific conditions and therefore are unable to provide a broad overview of a patient’s health status – an effective treatment may increase utility substantially as the treatment directly affects</td>
</tr>
</tbody>
</table>
Advantages | Disadvantages
--- | ---
are likely to be more sensitive to changes in health status because of treatment, relative to generic measures | the dimensions covered in the questionnaire, whereas broad HRQOL (captured by generic measures) might not have improved substantially
- Utilities based on these measures can only be compared across CEAs that use the same measure

**Mapping to EQ-5D from condition-specific non-preference-based measures**
- Mapping is a useful post-hoc solution when QOL data were not collected using preference-based measures
- Mapping may also be helpful when synthesising evidence for a CEA

**Mapping to EQ-5D**
- The use of mapping (as opposed to direct measurement using generic preference-based measures) may increase the uncertainty around the HRQOL data in economic models, and therefore around CEA results
- The use of mapping reduces comparability between CEAs
6 Conclusion

Obtaining utilities using EQ-5D to capture QOL is recommended by numerous HTA agencies worldwide, including NICE and ICER. Whilst this enables comparisons across different health conditions, EQ-5D is limited in its ability to measure QOL and changes in QOL in some conditions. This is because EQ-5D is not broad enough in some cases to adequately capture all QOL dimensions of relevance to patients, and in other cases is not sensitive enough to identify changes in patients’ QOL resulting from a treatment.

There are several alternatives to EQ-5D for describing QOL and obtaining utilities. As each has their own advantages and disadvantages, there is no single approach that can be viewed as always superior to others.
References


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