

Appendix to 14 March 2003 NZMJ viewpoint article ‘PHARMAC measures savings elsewhere to the health sector’:

Quality-adjusted life years saved (QALYS) and how to measure them

Health interventions ultimately aim to extend life expectancy and/or enhance health and independence. They do this by curing or ameliorate illness and disability, and/or preventing or delaying the onset or worsening of illness, disability and premature death.

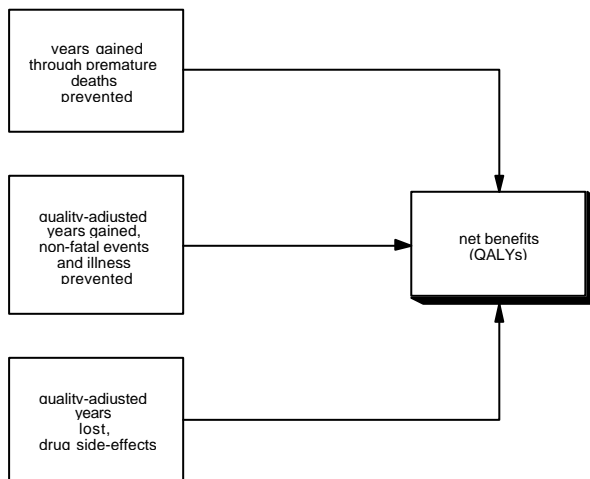
These outcomes, although different, can be in theory covered by single measures such as quality-adjusted life years saved (QALYS), which combine all aspects of benefits in the same way.

The concept of the QALY was first introduced in 1968, and QALYs are extensively used in health sectors worldwide to inform resourcing decisions. Further details can be found in standard texts such as Drummond MF, O’Brien B, Stoddart GL, Torrance GW. *Methods for the economic evaluation of health care programmes*, 2nd edition. Oxford: Oxford University Press, 1997.

Common end-points such as QALYS are termed “utilities”, and measure the benefit part of cost-utility analyses. This differs from what happens in formal cost-benefit analyses, where benefits are all measured in monetary terms.

QALYS incorporate an intervention’s impact on both death and illness and the effects of side effects.:

Benefits (QALYs) =
Number of quality-adjusted years saved through preventing or delaying premature death
+ number of quality adjusted life years gained through illness avoided or delayed
- number of quality-adjusted life years lost from side effects
- loss of benefits from substitution for other drugs or treatment regimes.



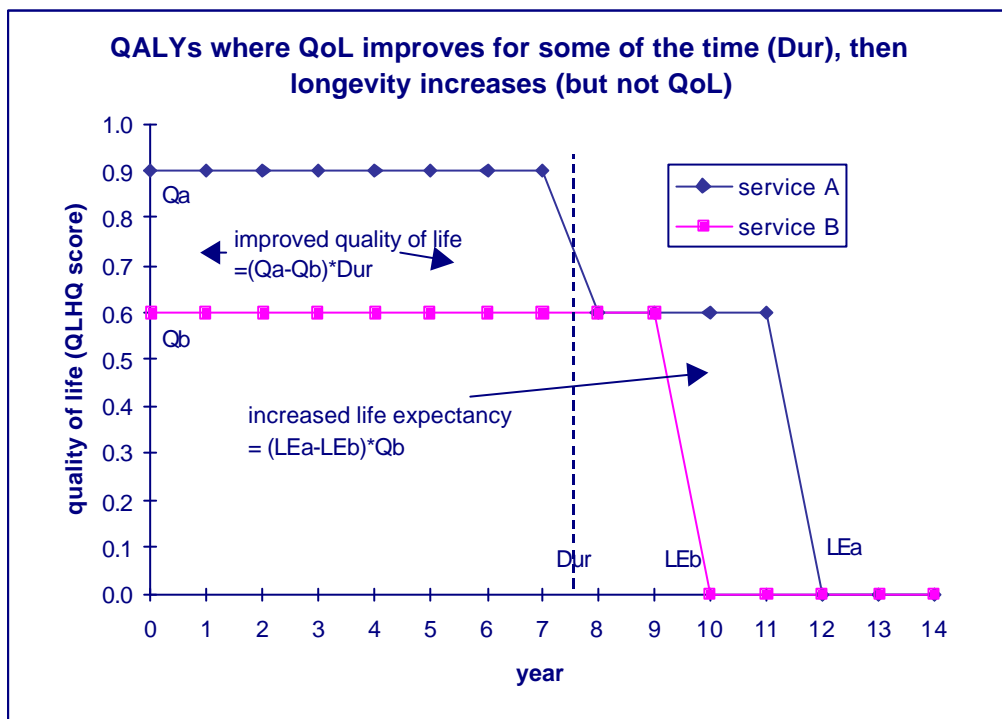
QALYS therefore measure the product of {change in life expectancy} and {change in quality of life} resulting from treatment.

We can look at how to calculate marginal QALY gains in a theoretical example of a proposed intervention (“Service A”) versus the default, existing, or alternative (“Service B”, which might be doing nothing) . The formula for assessing the marginal QALY gain obtained from Service A relative to Service B is:

$$\frac{[(Q_a - Q_b) * Dur]}{\text{Quality of Life Benefit}} + \frac{[(LE_a - LE_b) * Q_b]}{\text{Life Expectancy Benefit}}$$

The components of this formula are depicted geometrically in Figure 1 below. Note the marginal QALY value will be negative when the QALY gain from Service B exceeds that of Service A.

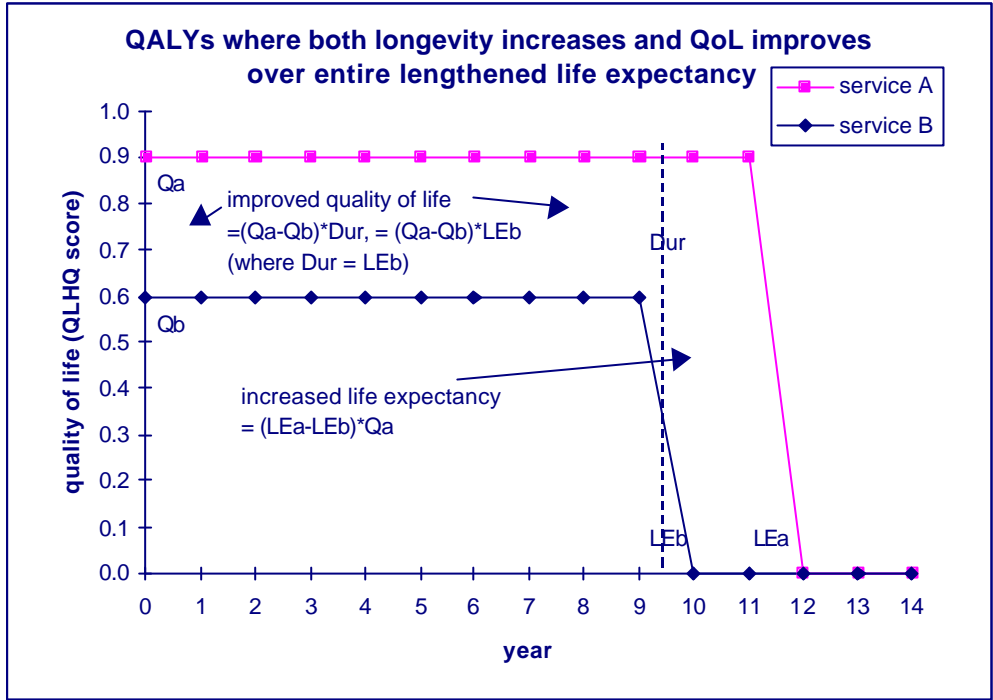
Figure 1



In this example, with service B (maybe conventional therapy) quality of life 0.6, with life expectancy of around 9.5 years (i.e. 50% of patients - the average patient - will die by 9.5 years). However, use of Service (or intervention or programme) A improves quality of life in these patients for the first 7.5 years (after which effects fade), moving up to 0.9, i.e. an improvement of $(0.9 - 0.6 =) 0.3$ over duration 7.5 years. Service A also improves longevity, with life expectancy rising to 11.5 years, i.e. an increase of $(11.5 - 9.5 =) 2.0$ years. This translates to $(0.3 * 7.5 + 0.6 * 2 =) 3.4$ QALYS through both improving quality of life and increasing life expectancy.

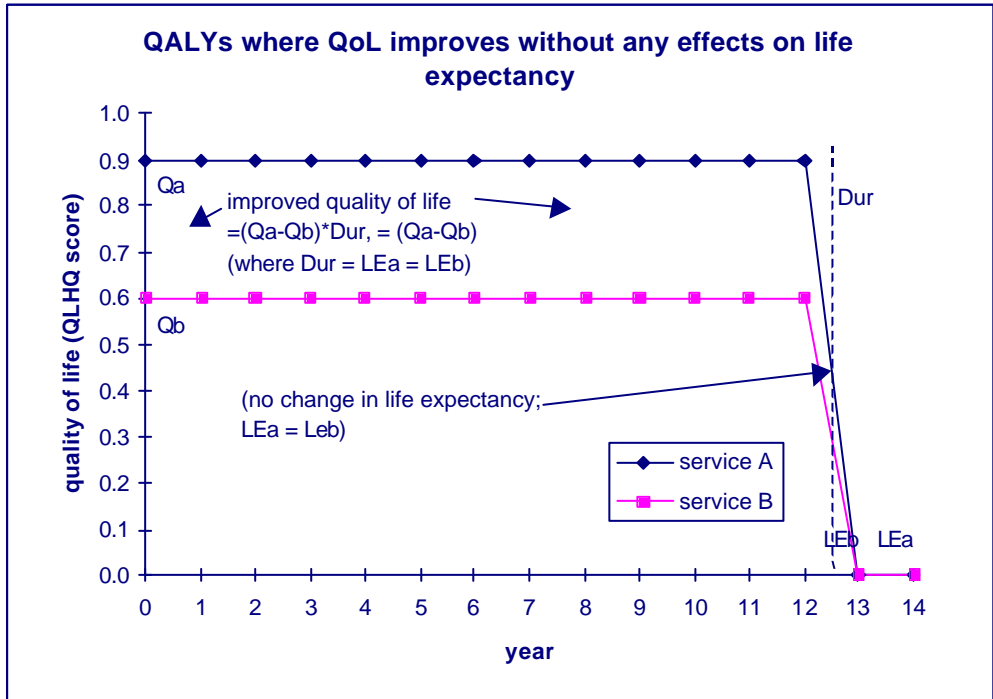
There are other possibilities. For instance, both longevity can increase and QoL improve over entire (lengthened) life expectancy, as might happen in life-saving interventions which also prevent the effects of non-fatal sequelae (figure 2):

Figure 2



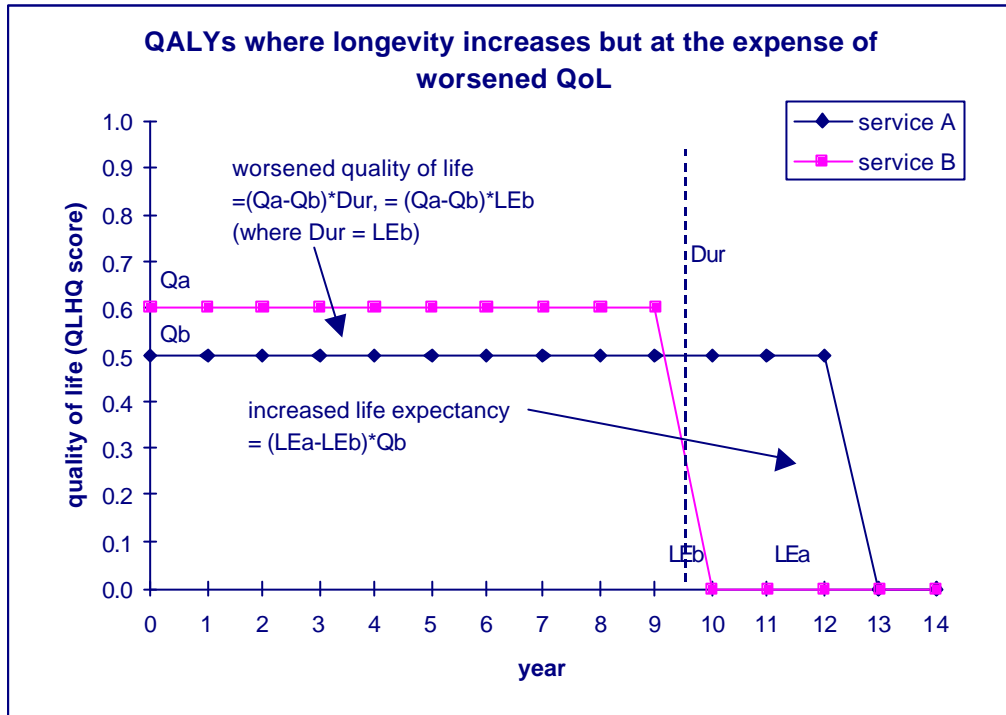
A variation might be where QoL improves, without any change in life expectancy. Examples might include disability support services that enhance QoL by improving independence (figure 3):

Figure 3



On the other hand, life expectancy might increase, but at the expense of worsened QoL over the remainder of life. This might happen, for instance, with some forms of vigorous cancer treatments (figure 4):

Figure 4



Of course, some interventions may increase both life expectancy and QoL in the medium to long term, but at the expense of some worsening of QoL in the short term. An example of this might be some forms of major surgery (figure 5):

Figure 5

