patients receiving dialysis may not be equivalent to life years for patients not receiving dialysis). However, this model has been applied in most cases for resource allocations only within the health sector, and usually just within a single therapeutic area.

Cost-effectiveness analysis without utility analysis may lead to conclusions unacceptable for some patients. For example, continuous ambulatory peritoneal dialysis (CAPD) for patients with end-stage renal disease is reported to be more cost-effective than hospital hemodialysis.[19] However, CAPD requires a patient to have a permanent catheter placed into the abdominal cavity to allow them to conduct dialysis at home, and patients need to instill and drain fluid into this catheter several times *per* day. In hospital hemodialysis, patients must go to the hospital a few times a week, but they are not required to do any of the procedures themselves and are released from the machine after three or four hours. There are no studies of patients' preferences for type of dialysis in Japan. If we assume that the survival from these two procedures is identical, and patients have significant loss of utility for their health state from CAPD, it is possible that an analysis from a patient perspective or a cost-utility analysis may recommend hospital hemodialysis, even if a cost-effectiveness analysis based only on survival recommends CAPD.

Cost-utility analysis: As described above, this analysis is a variant of cost-effectiveness analysis. Cost-utility analysis adds quality of life adjustment to outcomes in cost-effectiveness analysis. Utility refers to the desirability or preference that individuals or societies have for a given outcome.[20] In most cases of utility assessment, the worst imaginable health state is scored at 0.0 and perfect health is scored at 1.0. Utility is shown by a number between 0.0 and 1.0. There are several popular methods for the direct measurement of such preferences, including the visual analog scale, time trade-off method, and standard gamble. Methods that examine patient preferences under conditions of risk or uncertainty are considered true utility assessments (time-trade-off or standard gamble). Methods that examine patient preferences not under these conditions are considered value assessments (visual analog scale).[20] For example, if a patient with hospital hemodialysis thought that 10 years of life with hospital hemodialysis would have the same value as 8 years of healthy life without dialysis (*i.e.* the patient would be indifferent between the two), the patient would have a utility value of 8/10, or 0.8 for hospital hemodialysis by the time trade-off method. The comparison of costs and utilities is referred to as cost-utility analysis.

Utility analysis is used for the calculation of quality-adjusted survival. Quality-adjusted life years (QALYs) attempt to combine expected survival with expected quality of life in a single metric. If an additional year of healthy life is worth a value of 1 (year), then a year of less healthy life is worth less than 1 (year).[21] For example, if a patient's life expectancy is 10 years and utility of patients on lifelong hospital hemodialysis is 0.3, the patient would be reported to have a life expectancy of 3 quality-adjusted life years.

Figure 3 depicts quality-adjusted life years gained through an intervention. Quality of life sometimes decreases and recovers, so the quality of life and the resulting QALYs vary over time as a result of a given treatment program. The difference in quality-adjusted life years between two programs, which is shown as an area "QALYs Gained," represents the incremental outcome of the treatments over time.

Utility is determined using either community preferences of the general public, of health professionals, or of patients experiencing the health states (and their surrogates), according to the purpose of the study.[22] For the reference case, community preferences are often adopted.[23] When an analysis is designed to evaluate alternative interventions for the same condition, or when assessing new interventions, patient preferences can be employed. Utility assessed using patient preferences for a condition is likely to result in higher numeric values than that assessed using community preferences for the same condition. This may be because patients tend to adjust themselves to a diminished health state,[23] or because community preferences may be biased due to incomplete knowledge of the disease or the treatment.

Cost-identification analysis (cost-minimization analysis): If treatment outcomes or benefits are equivalent for the therapies being evaluated, it is appropriate to employ cost-identification analysis, which compares

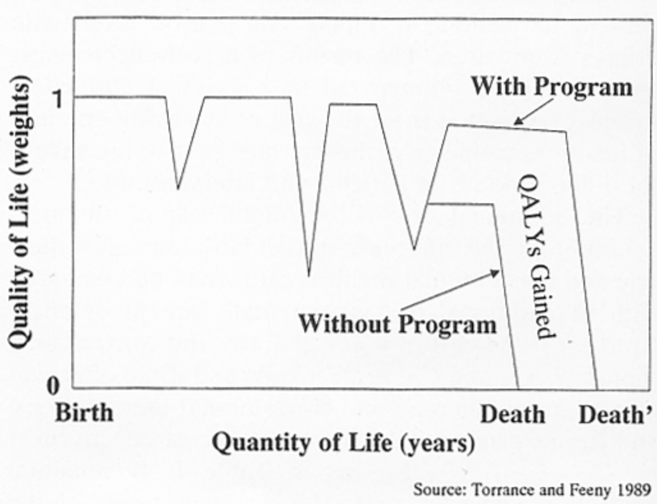

Fig. 3 Quality-adjusted life years gained.