

## *Original Article*

# Health-Related Quality of Life of Colles' Fracture Patients

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**Abstract.** Recent guidelines published by the National Osteoporosis Foundation (NOF) make extensive use of quality-adjusted life-years (QALYs). Crucial to these guidelines, therefore, are the assumptions that are made about the health-related quality of life (HRQoL) gained from the avoidance of osteoporotic fractures. This paper reports on a study in which 50 Colles' fracture patients were asked to describe their health at each visit during treatment using the EuroQol descriptive system and to value their own health using the visual analogue scale (VAS). By applying a set of population-derived valuations to the states reported by the patients, the QALY loss is shown to be about 2%. This is about half of the loss, based upon clinician judgement, that is contained in the NOF guidelines. In addition, the results suggest that it may be possible to use VAS scores to predict treatment requirements, since those patients who require fewer visits have, on average, higher initial VAS scores.

**Keywords:** Colles' fracture; EQ-5D; Health status measurement; QALYs; Visual analogue scale

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## Introduction

Given limited health care resources, it is important to develop efficient strategies for the prevention of osteoporotic fractures. This has been recognized in the recent National Osteoporosis Foundation (NOF) guidelines [1]. The guidelines make extensive use of cost-utility analysis (CUA) and suggest that the prevention of osteoporotic fracture is 'cost-effective' if a given

strategy produces a cost per quality-adjusted life-year (QALY) of \$30 000 a year or less.

Assumptions made about the health-related quality of life (HRQoL) gained from avoiding osteoporotic fractures are crucial here. To date they have, at best, been based on the judgements of clinicians, since there are no empirical estimates of the utility loss associated with an osteoporotic fracture. This paper presents patient-derived HRQoL weights that can be used to calculate the QALY loss for one of the common osteoporotic fractures, namely Colles' fracture.

## Methods

There are two main stages in the development of any measure of HRQoL. The first is to describe health states and the second is to value the states so described. The EQ-5D descriptive system [2] was used in this study since it is one of the few instruments that enables different dimensions of health to be combined to form an overall single index, as is required for calculating QALYs.

One of the main methods used to value health states (particularly if such values are subsequently used to calculate QALYs) is the time trade-off (TTO) method. In a recent study, TTO valuations for a subset of EQ-5D states were elicited from over 3000 members of the UK general population [3]. And from these data, 'tariff' values (on a scale in which 1 and 0 represent full health and death, respectively) have been estimated for all 243 EQ-5D states [4]. The number of QALYs gained as a result of treatment and the number of QALYs lost as a result of fracture can then be calculated by applying 'tariff' values to the health states reported by patients.

In this study, 50 consecutive female Colles' fracture patients attending the outpatient clinic at Sheffield

Hallamshire Hospital between 1 February and 31 May 1997 were asked to describe and value their health at each visit. At the first visit, patients were asked to rate retrospectively what their health was like at their initial Accident and Emergency visit.

Patients were first asked to describe their current health using the EQ-5D. The mobility dimension was omitted from the questionnaire because a Colles' fracture is unlikely to affect this dimension of health. Therefore, the loss associated with it has instead been calculated by looking firstly at what percentage of the UK female population (matched by the ages in this study) report problems on this dimension. This percentage (36%) has then been multiplied by the decrement associated with level 2 mobility (0.069) to give an estimated loss of 0.025 on mobility for each patient. The patients were then asked to value their current health status on a visual analogue scale (VAS) with 100 (best imaginable health state) and 0 (worst imaginable health state) as endpoints.

The patient's age, the date of each visit and whether or not they required an overnight stay in hospital were all recorded. To test the effect of these variables on each other and on the description and valuation of health, whilst retaining reasonable sample sizes, each patient was recoded as follows: (i) those aged under 70 years ( $n = 20$ ) and those aged 70 years or over ( $n = 30$ ); (ii) those who had two or three visits ( $n = 22$ ) and those who had four or more visits ( $n = 28$ ); (iii) those who were discharged in 6 weeks or less ( $n = 23$ ) and those who were discharged after more than 6 weeks ( $n = 27$ ); (iv) those admitted to hospital ( $n = 20$ ) and those not requiring an overnight stay ( $n = 30$ ).

The severity of the fracture was not graded but the fractures in patients admitted to hospital were severe and of unstable configuration and hence required intervention under general anaesthesia. The functional outcome was graded at the last visit, including the extent to which patients could perform self-care, their daily activities and work and leisure activities (i.e., dimensions covered by the EQ-5D).

## Results

The average age of the 50 patients was 71.46 years with a standard deviation of 8.39 years and a range of 52–91 years. Each patient made between two and six outpatient visits (mean 3.82), with an average length of time between the first and last visit of 48.26 days (SD 26.08). The 20 patients admitted to hospital stayed for a total of 62 nights. Rather unsurprisingly, the number of visits made and the time between the first and last visit were correlated with one another ( $\chi^2 = 25.77, p 0.000$ ). It also appears that whether a patient is required to stay overnight or not is related to their age: 12 of 20 patients aged under 70 years stayed overnight compared with only 8 of the 30 patients aged 70 years or over ( $\chi^2 = 5.56, p 0.018$ ).

Table 1 shows the health states that the patients claimed to be in on their first and last visits to hospital. It can be seen that states 2221 and 2222 account for 43 (86%) of the patients on their first visit whilst 38 (76%) are discharged in state 1111. All patients reported an improvement in their health over the course of their treatment, with 42 'moving up' at least one level on three of the four dimensions. The most common changes in health status are movements up one level on all dimensions and movements up one level on all dimensions except anxiety/depression, which account for 16 and 17 patients respectively.

Table 2 shows the tariff values for all of the states reported at any of the visits, assuming that the loss associated with the mobility dimension is 0.025 for all states. Using the frequencies reported in Table 1, it is possible to calculate the average health state values at the initial and final visits. These figures are 0.539 (SD = 0.162) and 0.925 (SD = 0.097), respectively. This means that, over the average treatment time of 48 days, there is an average increase of 0.386 (SD = 0.189).

A patient's initial and final health states, the change in their health state, and hence the corresponding tariff values, do not appear to be affected by their age or by whether or not they have an overnight stay. However, there is a difference on the self-care dimension according to the number of visits they have and according to the length of time before discharge. Although there is no

**Table 1.** The initial and final health states of patients

Health state <sup>a</sup>	Initial state ( $n = 50$ )	Final state ( $n = 50$ )
1111		38
1121		2
1211		3
1221		1
2111		2
2211	1	2
2221	19	2
2222	24	
2231	1	
2232	2	
2321	1	
3222	1	
3322	1	

<sup>a</sup>The four-digit code comes from the particular level reported on each of the four dimensions of the EuroQol used in this study:

- 1 No problems with self-care
- 2 Some problems washing or dressing self
- 3 Unable to wash or dress self
- 1 No problems performing usual activities (e.g., work, study, housework)
- 2 Some problems performing usual activities
- 3 Unable to perform usual activities
- 1 No pain or discomfort
- 2 Moderate pain or discomfort
- 3 Extreme pain or discomfort
- 1 Not anxious or depressed
- 2 Moderately anxious or depressed
- 3 Extremely anxious or depressed

**Table 2.** UK tariff values for all states reported by patients

Health state	Tariff value
1111	0.975
1211	0.858
2111	0.790
2211	0.754
1121	0.771
1221	0.735
2121	0.667
1222	0.664
2221	0.631
2222	0.560
3211	0.375
2321	0.304
3222	0.181
3322	0.123
2231	0.099
2232	0.028

difference between the groups in the level reported for this dimension at the initial visit, all 6 patients who claimed at their final visit (as well as at their first one) to have some problems washing or dressing have two or three visits and are discharged within 6 weeks.

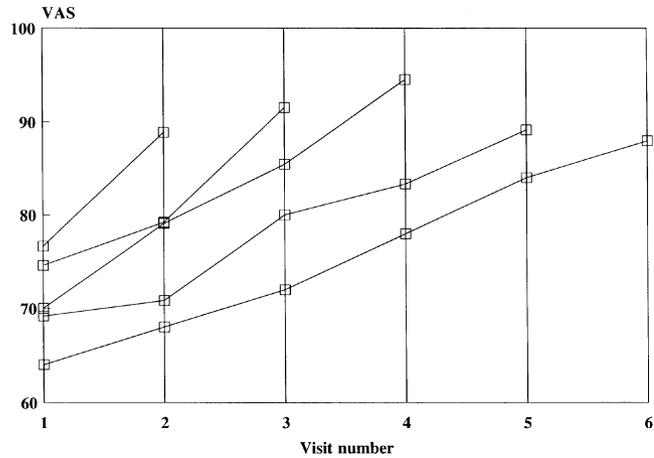
Therefore, the number of visits and the time between the first and last visits both affect the change in tariff value. The change for the groups requiring only two or three visits or discharged within 6 weeks is about 0.33, compared with a change of about 0.43 for the groups requiring four or more visits or discharged after 6 weeks. These differences are significant at the 5% level.

The QALY value associated with the year of fracture has been calculated for each patient by multiplying the value attached to each health state by the time spent in that state. To do this, it is assumed that (i) the health state value between visits  $n$  and  $n+1$  is the average of the values for the states reported at visits  $n$  and  $n+1$  and (ii) the patient remains in the state they are discharged in for the rest of the year. The mean QALY value is 0.907 (SD = 0.094) with a range from 0.630 to 0.973. On the assumption that patients are discharged in health states that they would have been in had they not had a Colles' fracture, the loss associated with fracture is therefore 0.018 (SD = 0.014).

Table 3 shows the VAS scores given by patients at their first and final visits. The average VAS score for the first visit is 71.6 and for the final visit is 90.8, representing an average increase of 19.20. Only 3 patients (all of

**Table 3.** The initial and final visual analogue scale (VAS) scores of patients

VAS score	Initial VAS ( $n = 50$ )	Final VAS ( $n = 50$ )
50	2	
60	10	
70	17	
80	20	8
90	1	30
100		12



**Fig. 1.** Visual analogue scale (VAS) scores by visit.

whom rated their own health at 80) indicated no improvement on the VAS, whilst the remaining 47 patients rated their health between 10 and 40 points higher on their final visit than on their first one.

The number of visits a patient has appears to be affected by their initial VAS score. Those patients requiring only two or three visits have an average initial score of 75.45 (SD = 7.39); the corresponding score for those requiring four or more visits is 68.57 (SD = 9.32). According to the  $t$ -test, these figures are statistically significantly different from one another at the 1% level of significance. The final VAS scores for the two groups are almost identical, which means that the change in the VAS score of those requiring two or three visits is about 7 points less than that of those requiring four or more visits – a difference that is again significant at the 1% level.

In addition, the VAS score at any one point in time also appears to be related to whether the patient is going to be discharged at that visit or not, as shown in Fig. 1. When, at the second (or third or fourth or fifth) visit, the VAS scores of those requiring only two (or three or four or five) visits are compared with the VAS scores of those requiring more than two (or three or four or five) visits, respectively, the scores of the former group are higher than the scores of the latter group. This finding is reinforced by the fact that the score at the  $(n+1)$ th visit is always significantly higher ( $p < 0.05$ ) than the score at the  $n$ th visit.

### Discussion

This paper has shown that it is feasible to measure HRQoL immediately after Colles' fracture and at various stages in the treatment process. It appears that patients had few problems describing and valuing their health as there were no missing data. The particular measure used, the EQ-5D, has been found to be sensitive to changes in HRQoL over time: whilst most patients are in 2221 or 2222 at their initial visit, they are in 1111 by their last visit.

Applying 'tariff' values to the states reported yields almost a 0.4 benefit from an initial position of about 0.5. This suggests that Colles' fracture itself results in a significant loss in HRQoL, and that treatment results in a significant benefit. These results are borne out by the VAS ratings of the patients: on average, patients rated their health at about 70 immediately after fracture but at about 90 when they were discharged.

However, the fact that three EQ-5D states account for two-thirds of the sample at both the initial and final visits suggests that the descriptive system is not very sensitive to differences in HRQoL that may exist between patients. As a result, there were few significant differences in the changes in HRQoL according to the background and treatment characteristics of the patients. These findings may have important implications for the use of EQ-5D in future studies; namely, it is more appropriate when measuring changes in HRQoL at the aggregate level but less appropriate when planning treatment at the individual level. In addition, some patients with Colles' fracture complain about difficulties with certain tasks (for example, using a screwdriver or turning a lid) up to a year after fracture, and the EQ-5D is unlikely to be sensitive enough to detect this.

The VAS performs better in a predictive capacity in that those patients who require fewer visits have, on average, higher initial VAS scores. It is also found that the VAS score at any particular visit is higher for those discharged at that visit than it is for those requiring additional visit(s). More research is needed to test the robustness of this finding in other therapeutic areas, but the potentially very useful implication is that it may be possible to use self-rated health information of this kind, which takes only a few seconds to gather, to predict future treatment requirements.

The QALY calculations suggest that the loss associated with Colles' fracture is about 2%. In a recent American Guidelines using clinical opinion it was assumed for Colles' fracture that there is a 30% loss in QALYs over a 7 week period, which translates into a 4% loss over a year [1]. The data in this study suggest a similar magnitude of QALY reduction, with an average loss of 39% loss that takes an average of 48 days to alleviate. However, the NOF guidelines estimate the QALY loss to be more than twice that found here because they assume that the initial loss lasts for the whole treatment period, after which normal health is restored. But, in fact, this study shows that patients get progressively better during the treatment period and hence the return to normal health is a gradual one. This finding is consistent with our intuition about the pattern of recovery from most dysfunction. As a result, the NOF guidelines overestimate the QALY loss: only 3 of the 50 patients in this study had a loss of greater than 4% and for 36 of them the loss was less than 2%. Therefore, the NOF guidelines should be tested using the estimates of QALY loss reported here.

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