Cost-effectiveness of MRI in managing suspected scaphoid fractures

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

CRD summary
This study evaluated the cost-effectiveness of magnetic resonance imaging (MRI) to identify scaphoid fractures. The authors concluded that MRI was cost-effective, due to reduced immobilisation time and sick leave. The reporting was clear and the methods were generally appropriate. The analysis of uncertainty was sufficient, but uncertainty remains due to the design of the study and its small sample. The authors’ conclusions appear overly certain given the study limitations.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study evaluated the cost-effectiveness of magnetic resonance imaging (MRI) to identify scaphoid fractures.

Interventions
With the intervention, patients with the clinical signs of a scaphoid fracture had their wrist immobilised in a dorsal splint. An MRI was performed within one week and the results were analysed for fracture. If no fracture was found, immobilisation was discontinued and patients were encouraged to return to normal use of the hand.

This was compared with usual care, in which patients were immobilised in a dorsal splint for two weeks, and then re-examined. If there were clinical signs of a fracture, but no radiological signs, the patient remained in the splint for an additional two weeks, and was re-examined. If clinical evidence of a fracture persisted, without radiological evidence, the splint was continued for another two weeks. Patients were encouraged to work with their splint if possible, and if radiology and clinical symptoms were normal, patients were encouraged to use their hand without a splint.

Location/setting
Denmark/out-patient care.

Methods
Analytical approach:
The economic evaluation was conducted alongside a prospective observational study. The sample of 27 patients in each group was based on a power calculation. Follow-up was three months. The study perspective was not explicitly stated.

Effectiveness data:
The prospective observational study was conducted at two local hospitals, serving similar populations and part of the same organisation with the same medical protocols. The two groups were compared on the patient’s type of work (blue collar, white collar, or unemployed), informal care needs, number of hospital visits, and kilometres to the hospital. The comparison was made with Fisher’s exact test and t-tests to show statistical significance. Patients at one hospital received the MRI protocol, and those at the other hospital received usual care. The primary effectiveness measure was the hand function score at follow-up. This was measured on a five-point scale, where a score of one was normal, and five was severe restriction. Other measures of effectiveness were the days with wrist immobilisation, and days off work. The effectiveness data were measured at three months after initial treatment, by patient interview.

Monetary benefit and utility valuations:
Not relevant.
Measure of benefit:
The measure of benefit was hand function, measured by the hand function score.

Cost data:
The resource use was from patient records, and included hospital visits and investigations. Productivity lost was also calculated. The costs of hospital visits and imaging were from 2007 Dutch diagnosis-related group codes. The patient costs for visits included travel time, and were calculated using Dutch tariffs and the cost of informal care for patients who were unable to perform normal daily tasks or work because of the splint. The rates were from the Dutch manual for costing in economic evaluations, adjusted for inflation. Productivity lost was calculated using 2006 Dutch daily average wage rates for a maximum of 92 days; productivity costs for the unemployed were calculated from a Dutch source and adjusted for inflation. Patient time and productivity lost were classified as non-hospital costs. The costs were reported in Euros (EUR).

Analysis of uncertainty:
Between-group differences in hospital costs, non-hospital costs, and total costs, were compared for statistical significance. Differences by blue collar and white collar work status were analysed. Uncertainty in the hand function and cost estimates was estimated using a bootstrap simulation and plotted on a cost-effectiveness plane. Bootstrap replications were adjusted for baseline differences in age, gender and employment status, using multivariate regression.

Results
The median hand function score was 2 (range 1 to 3) for usual care, and 2 (range 1 to 4) for MRI (p=0.70). The adjusted mean difference was 0.2 (95% CI -0.3 to 0.7) in favour of usual care. Immobilisation time was 20 days (range six to 54) with usual care, and four days (range one to 19) with MRI (p<0.01). Time off work was 27 days (range one to 92) with usual care, and 11 days (range zero to 28) with MRI (p<0.01).

With MRI, the hospital costs were EUR 151 more, but non-hospital costs were EUR 2,869 less, than with usual care. The total cost was EUR 5,100 with usual care, and EUR 2,382 with MRI; an unadjusted difference of EUR 2,718 in favour of MRI. When adjusted, this difference increased to EUR 2,927 (95% CI 1,047 to 5,200).

Blue-collar workers showed a statistically significant difference in total costs, with no statistically significant difference for white-collar workers (p=0.1). The cost-effectiveness plane showed that all bootstrap replications were less costly for MRI compared with usual care, but most were less effective and some were more effective.

Authors’ conclusions
The authors concluded that MRI was cost-effective for suspected scaphoid fractures, due to reduced immobilisation time and sick leave.

CRD commentary
Interventions:
The interventions were generally clearly described and appear to have been appropriate. The treatment for patients who had their fracture confirmed by MRI was unclear; the hand probably remained in a splint for up to six weeks. The type of radiography for usual care was not reported, but detailed costs should allow comparison with local costs.

Effectiveness/benefits:
The effectiveness and benefits were clearly reported. The primary measure of benefit was hand function, on a five-point scale. It was not clear whether this was a standardised measure, or unique to the study. The effectiveness data were gathered at three months after the initial treatment, which could lead to recall bias. The last examination, with usual care, was conducted at six weeks for two patients, four weeks for seven patients, and two weeks for 18 patients. For MRI, the last examination was within one week of the start of treatment. This resulted in a difference between last examination and follow-up, ranging from 1.5 months, to nearly three months.

Costs:
From the costs analysed, the perspective appears to have been societal. The costs seem to have been from appropriate Dutch sources, and were adjusted for inflation, where necessary. The cost sources were from either 2006 or 2007 and the price year was not explicitly reported. It was not clear how the costs were inflated and to which price year. The
productivity costs were captured by wages lost due to missed work (absenteeism), but no costs were calculated for reduced productivity while at work due to injury (presenteeism). It is unclear what effect including these costs would have on the outcomes.

Analysis and results:
It appears that appropriate methods were used to adjust for differences between groups. The results were clearly presented with unadjusted and adjusted figures. Sensitivity analyses were clearly reported and appear to have used appropriate methods. No incremental cost-effectiveness ratio was reported for usual care versus MRI, and no probabilities of cost-effectiveness were presented. No threshold at which an intervention might be considered cost-effective, for the hand function outcome was reported; there may be no established threshold for increased hand function. The authors conducted a thorough comparison of their work with that of similar studies and presented reasons for any differences. Most of these studies had similar perspectives, in economically comparable nations. The authors acknowledged some limitations to their study, but they underemphasised the possible effects of the small sample, no randomisation, and potential institutional differences, on the representativeness and validity of their results.

Concluding remarks:
The reporting was clear and the methods were generally appropriate. The analysis of uncertainty was sufficient, but uncertainty remains due to the design of the study and its small sample. The authors' conclusions appear overly certain given the study limitations.

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