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 examined the cost-effectiveness of selective head computed tomography (CT), according to various protocols, in patients with a minor head injury. The authors concluded that selective head CT could be cost-effective, but the uncertainty in the long-term functional outcomes and in the sensitivity of the selection protocols, might justify a routine CT for all patients. The study was well conducted, but most of the data were presented in an online appendix. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective was to examine the cost-effectiveness of the selective use of head computed tomography (CT) according to various protocols, in patients with a minor head injury, compared with a head CT for all patients.

Interventions
The strategies were head CT for all patients; for those who met the New Orleans criteria (NOC); for those who met the Canadian CT head rule (CCHR); and for those who met the CT in head injury patients (CHIP) rule. These strategies were compared with no head CT, as the reference strategy.

Location/setting
Netherlands/tertiary care (emergency department).

Methods
Analytical approach:
A decision tree was used for the short-term analysis (one year) and this was extended using a Markov model to the lifetime horizon. The authors stated that a societal perspective was adopted.

Effectiveness data:
The bulk of the clinical evidence came from the multi-centre CHIP Study of 3,364 consecutive patients with a minor head injury at four Dutch university hospitals, data from 3,181 patients were used. Those data not available from the CHIP Study were identified in a literature review in the PubMed database. No details on the design or other characteristics of these studies were provided. The key assumption of the model was the CT sensitivity, which was assumed to be 100% for lesions that required neurosurgery.

Monetary benefit and utility valuations:
The utility values were derived from a subsample of CHIP Study patients, who were interviewed by telephone, using the European Quality of life (EQ-5D) questionnaire.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and they were discounted at an annual rate of 3%.

Cost data:
The economic analysis included the direct health care and non-health care costs of the emergency department visit, neurosurgical procedure, CT examination, intensive care observation, out-patient visit, physiotherapy session, patient
travel, and productivity lost. The cost of a head CT was based on an economic study, while all the other costs were provided by the Dutch Health Care Insurance Board. Resource use was mainly from the CHIP Study. All costs were converted to US dollars ($) and were discounted at an annual rate of 3%. The price year was 2006.

Analysis of uncertainty:
Deterministic and probabilistic sensitivity analyses were carried out. The deterministic analysis consisted of one-, two-, and three-way analyses on the model inputs, using ranges of values derived from the literature. A second-order Monte Carlo simulation was conducted and the probabilistic distributions were presented in an online appendix. The expected value of perfect information (EVPI) was determined to assess the value of performing further research to decrease the uncertainty in the model inputs.

Results
Over a lifetime, the expected costs were $8,800 with the CCHR, $8,854 with the CHIP rule, $8,923 with the NOC, $8,933 with all patients, and $9,703 with no CT. The QALYs were 22.46393 with the CCHR, 22.46395 with the CHIP rule, 22.46391 with the NOC, 22.46390 with all patients, and 22.43444 with no CT.

The incremental analysis showed that all selective CT strategies were almost equally effective, but the CCHR was the cheapest and thus the most cost-effective option. The CCHR and the CHIP rule led to the greatest cost savings in comparison with the NOC.

The key finding of the deterministic analysis was that, when the sensitivity (ability to correctly identify cases that need neurosurgery) of the selective strategies was lower than 97%, a CT for all patients was the most cost-effective strategy (at a threshold of $75,000 per QALY) and when the sensitivity was lower than 91%, a CT for all patients was dominant, which means it was more effective and cheaper than the alternatives.

The probability that selective CT was cost-effective compared with a CT for all patients ranged from 0.51 to 0.64 depending on the cost-effectiveness threshold. The EVPI was $7 billion for five years for the US population. The partial EVPI indicated that this value was due to the uncertainty around the long-term functional outcomes.

Authors' conclusions
The authors concluded that the selective use of head CT had the potential to be cost-effective, but the uncertainty in the long-term functional outcomes of patients and in the sensitivity of the selective options, might justify the routine use of CT in all patients.

CRD commentary
Interventions:
The rationale for the selection of the comparators was clear and an extensive description of each selection protocol was given.

Effectiveness/benefits:
The clinical data were mostly from a large diagnostic study conducted in a number of Dutch hospitals. The large sample, the relatively long patient follow-up, and the inclusion of more than one institution, were appropriate and the data should be representative of the authors’ setting. Other data were identified by a literature review, but the details were not reported and no information on the design and characteristics of the selected study was provided. This means that the relevance of these sources cannot be judged. Some assumptions were made and the impact of changes in these assumptions was extensively investigated in the sensitivity analysis. QALYs were an appropriate benefit measure, as they consider both the quality of life and the life expectancy of patients and they allow comparisons with other diseases. The EQ-5D was a valid instrument for eliciting the preferences and it was used with patients from the clinical study.

Costs:
The analysis reflected the economic perspective and the cost categories were fully reported in an online appendix. The data sources were consistent with the viewpoint. The resource use and unit costs were presented separately, which will allow the study to be replicated in other settings. The price year, currency conversions, and the discount rate were reported. Overall the economic analysis was conducted satisfactorily.
Analysis and results:
The results were clearly presented and were synthesised using an incremental approach, which was appropriate for identifying the best strategy. The issue of uncertainty was satisfactorily investigated, using various approaches, and the findings were reported and discussed. The probabilistic distributions were presented in the online appendix and were typical for each parameter. A simplified diagram of the decision model was given. The authors acknowledged some limitations of their analysis, which mainly related to the high uncertainty in some of the model parameters.

Concluding remarks:
The study was well conducted, but most of the data were presented in an online appendix. The authors’ conclusions appear to be robust.

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