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.

Health technology
Ambulance dispatch protocols for non-traumatic abdominal pain. Six ambulance protocols were considered: indiscriminate dispatch, four selective protocols consisting of rules based on duration of pain, history of syncope, patient age and gender, and no-dispatch.

Type of intervention

Economic study type
Cost-utility analysis and cost-effectiveness analysis.

Study population
Patients who called 911 for non-traumatic abdominal pain.

Setting
County emergency medical services (EMS) system. The economic study was conducted in California, USA.

Dates to which data relate
Not stated.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
Costing was undertaken retrospectively on the same patient sample as that used in the effectiveness study.

Study sample
Power calculations were not used to determine the sample size. Records of 902 patients who called 911 for non-traumatic abdominal pain were reviewed; 114 of these cases were excluded because of lost records or insufficient chart data. A total of 149 patients requested ambulances and then refused transport, or could not be found at the scene. Their records were also excluded from the analysis. The number of ambulances dispatched by protocol (for protocol 1, indiscriminate dispatch, to protocol 6, no dispatch) were 788 (100%), 435 (55%), 353 (45%), 206 (26%), 84 (11%), and 0 (0%), respectively. A total of 39 county EMS medical directors were asked to assign utility values to four potential outcomes of ambulance dispatch by the direct scaling method. The response rate was 69% (27 directors).
Study design
This was a retrospective cohort study, carried out in a county EMS system covering five hospitals. The duration of the follow-up was until discharge (the study period was 6 months). No loss to follow-up was reported.

Analysis of effectiveness
The principle (intention to treat or treatment completers only) used in the analysis of effectiveness was not explicitly specified. The main outcomes used in the analysis were rates of undertriage (incorrect classification of true emergency as a low priority, and overtriage (incorrect classification of non-emergency as a high priority) for the six protocols. County EMS medical directors assigned utility values to four potential outcomes of ambulance dispatch by the direct scaling method (+100 for the most desirable and -100 for the least desirable option); these outcomes comprised correct and incorrect decisions to dispatch ambulances to patients with and without emergencies.

Effectiveness results
The four selective ambulance dispatch protocols had overtriage rates ranging from 10% to 51% and undertriage rates of 4% to 7%. The overtriage and undertriage rates for the indiscriminate dispatch protocol were 92% (95% CI: 90 - 94%) and 0%, respectively. The corresponding values for the no dispatch protocol were 0% and 8% (95% CI: 6 - 10%), respectively.

The median, and mean (range) utility values were:
correct triage, dispatch, +100, +94 (+75 to +100);
correct triage, no dispatch, +25, +33 (-50 to +100);
undertriage, -100, -94 (-100 to -70);
and overtriage, 0, -7 (-100 to +75).

Clinical conclusions
None of the protocols was proven superior on the basis of medical directors' assignment of utility values.

Modelling
Decision analysis was employed to compare the six protocols in terms of costs and benefits. A decision tree was used with the utilization of D-Marker software (Digital Medicine, Incorporated).

Measure of benefits used in the economic analysis
Expected utility was considered as the main benefit measure. The utility values were based on medical directors' preferences.

Direct costs
Costs were not discounted due to the short time frame of the study. Quantities were not systematically reported separately from the costs (except for average response time). Direct health service costs were considered such as the charge for dispatching advanced life support ambulances. The marginal cost of providing ambulance service was used to estimate the costs associated with overtriage and correct dispatch decisions. The cost of an alternative mode of transportation (taxi) was used to estimate the cost of a correct decision not to dispatch. A range of values was used (in the sensitivity analysis) for the true cost of undertriage error (medical costs, legal costs, and so on) since it was not known. The perspective adopted in the cost analysis was that of a health care provider. The date to which the price data referred was not explicitly specified. The costs of ambulance accidents were not incorporated in the model since no such accidents were recorded during the study period.
**Indirect Costs**
Indirect costs of inappropriately dispatching an ambulance and transporting a patient with a minor problem to the hospital were considered. Indirect costs relating to overtriage, such as loss of work-days due to illness, were mentioned, but not quantified.

**Currency**
US dollars ($).

**Sensitivity analysis**
One-way and two-way sensitivity analyses were performed on utility values, prevalence of true emergencies, cost of an undertriage error, ambulance costs. Threshold values were reported for the above parameters.

**Estimated benefits used in the economic analysis**
The expected utility for each protocol was not reported in figures.

**Cost results**
The marginal cost of dispatching advanced life support ambulances to all patients with this complaint was $3,838 per emergency. The average cost of indiscriminate dispatch protocol was $6,838. The cost associated with other protocols were not reported in figures, being simply plotted against the cost of undertriage error.

**Synthesis of costs and benefits**
It was reported that, with the baseline values, the no dispatch option was the optimal policy. The results were reported to be sensitive to small changes in the utility values assigned to overtriage and to a correct decision not to dispatch. The threshold value for the cost of an undertriage error was $3,674, above which the indiscriminate ambulance dispatch was the optimal option.

**Authors' conclusions**
The majority of patients with non-traumatic abdominal pain who requested ambulance transport during the study period did not have conditions that were classified as emergencies. If an undertriage error costs more than $3,674, indiscriminate ambulance dispatch is the least expensive protocol; if it costs less than $3,674, no ambulance dispatch is the least expensive strategy.

**CRD COMMENTARY - Selection of comparators**
The reason for the choice of the comparator is clear.

**Validity of estimate of measure of benefit**
The internal validity of the effectiveness results and estimate of benefit may have been weakened by the retrospective nature of the study design.

**Validity of estimate of costs**
Resource utilisation was not systematically reported separately from the costs and insufficient details of the methods of cost estimation were given. The study lacked a prospective and comprehensive cost analysis.

**Other issues**
In view of the lack of a prospective study design, the results may need to be treated with some caution.

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