Systematic reviews of clinical decision tools for acute abdominal pain

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Executive summary

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Background
Making accurate decisions for patients with acute abdominal pain (AAP) is difficult. To avoid missing seriously ill patients, many undergo unnecessary surgery, with negative laparotomy rates of 25%. However, delays can lead to 20% perforation rates. Many conditions cause AAP and no single clinical finding or test is both specific and sensitive. Many decision tools (DTs) combining two or more findings have been developed to aid AAP management, but no consensus exists on their appropriateness for clinical use.

Objectives
The study aimed to answer the following questions.

1. What are the diagnostic accuracies of DTs and doctors aided by DTs compared with those of unaided doctors?
2. What is the impact of providing doctors with an AAP DT on patient outcomes, clinical decisions and actions?
3. What factors are likely to determine the usage rates and usability of a DT?
4. What are the associated costs and likely cost-effectiveness of these DTs in routine use in the UK?

Methods

Data sources
MEDLINE, EMBASE, CINAHL, INSPEC CENTRAL, SIGLE, and HEALTH-CD were searched for empirical English-language studies. Searches were conducted to 1 July 2003.

Study selection (inclusion criteria)
For question 1, the criteria for eligible studies included:

- Unselected patients with AAP were recruited consecutively or randomly sampled from a primary or secondary care setting.
- Patients had previously undiagnosed AAP lasting for 7 days or less from onset.

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Results

Question 1
Thirty-two studies from 27 articles, all based in secondary care, were eligible for the review of DT accuracies, while two were eligible for the review of the accuracy of hospital doctors aided by DTs. Sensitivities and specificities for DTs ranged from
53 to 99% and 30 to 99%, respectively. Those for unaided doctors ranged from 64 to 93% and 39 to 91%, respectively. Thirteen studies reported false-positive and false-negative rates for both DTs and unaided doctors, enabling a direct comparison of their performance. In random effects meta-analyses, DTs had significantly lower false-positive rates (error rate ratio 0.62, 95% CI 0.46 to 0.83) than unaided doctors. DTs may have higher false-negative rates than unaided doctors (error rate ratio 1.34, 95% CI 0.98 to 1.93). Significant heterogeneity was present.

Two studies compared the diagnostic accuracies of doctors aided by DTs to unaided doctors. In a multiarm cluster RCT (n = 5193), the diagnostic accuracy of doctors not given access to DTs was not significantly worse (sensitivity 28.4% and specificity 96.0%) than that of three groups of aided doctors (sensitivities of 42.4–47.9%, and specificities of 95.5–96.5%, respectively). In an uncontrolled before-and-after study (n = 1484), the sensitivities and specificities of aided and unaided doctors were 95.5% and 91.5% (p = 0.24) and 78.1% and 86.4% (p < 0.001), respectively.

The metaregression of DTs showed that:

- prospective test-set validation at the site of the tool’s development was associated with considerably higher diagnostic accuracy than prospective test-set validation at an independent centre [relative diagnostic odds ratio (RDOR) 8.2; 95% CI 3.1 to 14.7]
- the earlier in the year the study was performed the higher the performance (RDOR 0.88, 0.83 to 0.92)
- when developers evaluated their own DT there was better performance than when independent evaluators carried out the study (RDOR = 3.0, 1.3 to 6.8)
- there was no evidence of association between other quality indicators and DT accuracy.

**Question 2**
The one eligible study of the impact study review, a four-arm cluster randomised trial (n = 5193), showed that hospital admission rates of patients by doctors not allocated to a DT (42.8%) were significantly higher than those by doctors allocated to three combinations of decision support (34.2–38.5%) (p < 0.001). There was no evidence of a difference between perforation rates (p = 0.19) and negative laparotomy rates in the four trial arms (p = 0.46).

**Question 3**
Usage rates of DTs by doctors in accident and emergency departments ranged from 10 to 77% in the six studies that reported them. Possible determinants of usability include the reasoning method used, the number of items used and the output format.

**Question 4**
A deterministic cost-effectiveness comparison demonstrated that a paper checklist is likely to be 100–900 times more cost-effective than a computer-based DT, under stated assumptions.

**Conclusions**

**Implications for healthcare**
- With their significantly greater specificity and lower false-positive rates than doctors, DTs are potentially useful in confirming a diagnosis of acute appendicitis, but not in ruling it out.
- The clinical use of well-designed, condition-specific paper or computer-based structured checklists is promising as a way to improve impact on patient outcomes, subject to further research.

**Recommendations for research**
This review uncovered important evidence gaps. The authors’ research recommendations include the following:

- Primary research to compare paper-based checklists with computer-based tools exploring the type/format that maximises patient benefit.
- Empirical research to identify the determinants of successful DTs, to provide more evidence to support the development of clinically useful tools.
- More general systematic reviews (across a range of diseases or tools) to assess (1) factors that make DTs more acceptable to doctors and patients and (2) the relative clinical value of paper checklists versus computer-based tools.

**Publication**
The research findings from the NHS R&D Health Technology Assessment (HTA) Programme directly influence key decision-making bodies such as the National Institute for Health and Clinical Excellence (NICE) and the National Screening Committee (NSC) who rely on HTA outputs to help raise standards of care. HTA findings also help to improve the quality of the service in the NHS indirectly in that they form a key component of the ‘National Knowledge Service’ that is being developed to improve the evidence of clinical practice throughout the NHS.

The HTA Programme was set up in 1993. Its role is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and provide care in the NHS. ‘Health technologies’ are broadly defined to include all interventions used to promote health, prevent and treat disease, and improve rehabilitation and long-term care, rather than settings of care.

The HTA Programme commissions research only on topics where it has identified key gaps in the evidence needed by the NHS. Suggestions for topics are actively sought from people working in the NHS, the public, service-users groups and professional bodies such as Royal Colleges and NHS Trusts. Research suggestions are carefully considered by panels of independent experts (including service users) whose advice results in a ranked list of recommended research priorities. The HTA Programme then commissions the research team best suited to undertake the work, in the manner most appropriate to find the relevant answers. Some projects may take only months, others need several years to answer the research questions adequately. They may involve synthesising existing evidence or conducting a trial to produce new evidence where none currently exists.

Additionally, through its Technology Assessment Report (TAR) call-off contract, the HTA Programme is able to commission bespoke reports, principally for NICE, but also for other policy customers, such as a National Clinical Director. TARs bring together evidence on key aspects of the use of specific technologies and usually have to be completed within a short time period.

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Reports are published in the HTA monograph series if (1) they have resulted from work commissioned for the HTA Programme, and (2) they are of a sufficiently high scientific quality as assessed by the referees and editors.

Reviews in Health Technology Assessment are termed ‘systematic’ when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.

The research reported in this monograph was commissioned by the HTA Programme as project number 97/38/03. The contractual start date was in May 2001. The draft report began editorial review in February 2006 and was accepted for publication in March 2006. As the funder, by devising a commissioning brief, the HTA Programme specified the research question and study design. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The HTA editors and publisher have tried to ensure the accuracy of the authors’ report and would like to thank the referees for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this report.

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