False-positive preliminary radiograph interpretations in a pediatric emergency department: clinical and economic impact

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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.

Health technology
Clinical impact and cost of false-positive preliminary radiograph interpretations in a pediatric emergency department (ED).

Type of intervention
Diagnosis; treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients undergoing radiography of the chest, abdomen, lateral neck (soft tissue), cervical spine, or extremities.

Setting
A university-affiliated, academic pediatric ED. The study was carried out at the Medical College of Wisconsin, Milwaukee.

Dates to which data relate
Effectiveness and resource data were prospectively collected from February to June 1991. 1995 prices were used.

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

Link between effectiveness and cost data
The collection of resource data was undertaken prospectively (alongside the effectiveness study).

Study sample
A total of 1,471 radiographic examinations were performed during the 5-month study period including 856 chest, 318 extremity, 161 abdomen, 79 lateral neck, and 57 cervical spine radiographs.

Study design
This was a prospective, case control study. The study method was described in an earlier report (see reference 6 in the article). All radiographs were initially interpreted by the ED physician and subsequently interpreted by a board-certified pediatric radiologist. All discordant radiograph interpretations resulted in a third independent interpretation by a
pediatric radiologist who was blinded to the two previous interpretations. The period of follow-up was not stated. Power calculations were not used to determine sample size.

**Analysis of effectiveness**
The clinical study was based on intention to treat. The primary health outcomes in the analysis were a reduction of misinterpretations (false-positive and false-negative) of results and a reduction in the cost of false-positive interpretations.

**Effectiveness results**
A total of 1,471 radiographic examinations were performed. Of these, 200 were misinterpreted: 103 (7%) were false-positive and 20 (10%) of the false-negative interpretations were determined to be clinically significant.

**Measure of benefits used in the economic analysis**
The primary health outcomes in the analysis were a reduction of misinterpretations (false-positive and false-negative) of results and a reduction in the cost of false-positive interpretations.

**Direct costs**
Direct costs included ED interventions, final diagnosis, discharge medication, private doctor follow-up visits, consultations and in-patient stay. The cost of additional interventions was calculated based on 1995 prices. No discounting was applied due to the short period of the study.

**Statistical analysis of costs**
Not stated.

**Currency**
US dollar ($).

**Sensitivity analysis**
Sensitivity analysis was not carried out.

**Estimated benefits used in the economic analysis**
All 11 false-positive lateral neck radiographs were interpreted as normal by the radiologist and no additional costs were incurred. The majority of the false-positive interpretations did not affect management. Although false-positive interpretations were noted in 7% of the patients, a rate higher than that reported in other studies, cost-positive over-interpreations were noted in only 0.6%.

**Cost results**
Nine cost-positive and false-positive radiographs incurred a total cost of $764.75 and an average cost of $84.97 per radiograph. Five cost-positive radiographs resulted in an average cost of $46.95 for antibiotic treatment. A repeated abdominal radiograph resulted in an additional cost of $96.25. Two patients had cost-positive misinterpretations resulting in a $110 charge for the first patient and a $238 charge for the second patient. False-positive extremity radiograph was obtained for further evaluation, resulting in an additional cost of $75.75. The estimated annual cost to expand the current attending radiologist coverage to 24-hour-a-day on-site was projected at $120,000 to $130,000.

**Synthesis of costs and benefits**
Costs and benefits were not combined.

**Authors' conclusions**
False-positive radiograph interpretations had limited economic and clinical impact. Further investigation of protocols for follow-up of these radiograph misinterpretations is needed to determine whether additional reductions in cost and patient inconvenience are possible.

**CRD COMMENTARY - Selection of comparators**
The choice of comparator was clear. The cost of false-positive interpretations was compared with an estimated cost of maintaining an on-site radiologist 24 hours a day.

**Validity of estimate of measure of benefit**
The validity of the estimate of benefits is likely to be sound as all radiographs were initially interpreted by the ED physician and subsequently interpreted by a board-certified pediatric radiologist. All discordant radiograph interpretations resulted in a third independent interpretation by a pediatric radiologist who was blinded to the two previous interpretations.

**Validity of estimate of costs**
The authors note that their estimate of costs is likely to be 'conservative' but in general the cost reporting could have been more comprehensive in relation to the question of generalisability to other settings.

**Other issues**
The authors seemed to achieve their first objective of determining the impact and cost of false-positive radiograph interpretations, although the cost methodology was not clearly specified. In addition, the second objective of comparing costs was not fully achieved. This was due to the lack of cost data and cost analysis presented. However, the issue of generalisability was addressed and good comparisons with other studies were made.

**Implications of the study**
Further investigations of protocols for follow-up of these radiograph misinterpretations is needed to determine whether additional reductions in cost and patient convenience are possible.

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