Management of childhood lead poisoning: clinical impact and cost-effectiveness

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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
Chelation therapy for lead poisoning.

Type of intervention
Diagnosis and treatment.

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

Study population
The model was based on a prototypical two-year old child with moderate lead poisoning [blood lead level 1.21 to 1.88 mmol]

Setting
Primary care. The economic study was carried out in USA.

Dates to which data relate
Effectiveness data was taken from a 1988 study. Cost data was from 1990.

Source of effectiveness data
Effectiveness data was based both on medical literature and the authors' assumptions.

Study sample
Not stated

Study design
Not stated

Analysis of effectiveness
The primary outcome was blood lead levels.

Effectiveness results
A course of penicillamine chelation reduced blood lead levels 90% of the time.
Modelling
A decision tree model was used to estimate costs and benefits.

Methods used to derive estimates of effectiveness
Estimates of effectiveness were based on the authors' assumptions.

Estimates of effectiveness and key assumptions
The decline in blood lead levels due to EDTA provocation testing, followed by chelation if testing is positive, was assumed to be 98%. Moreover, it was assumed that both EDTA and penicillamine chelation reduce the risk of developing reading disability by 70%.

Measure of benefits used in the economic analysis
The benefit measures used were cases of reading disability prevented and quality-adjusted life years. Quality of life estimates was based on a survey of clinicians in Boston. A scale of 0 to 1.0 was used. Other details were not given.

Direct costs
Only medical costs were considered. Costs included were laboratory and diagnostic test expenses for: blood lead level, complete blood count, electrolytes (blood and urine), urine lead level, chest x-ray, etc, medication costs and costs of hospitalisation and outpatient visits.

Costs were obtained from hospital records.
Costs were discounted at 5%.

Currency
US dollars

Sensitivity analysis
Sensitivity analysis was carried out to investigate the effect of variability in data, e.g. effectiveness levels, costs of tests, toxicity, life expectancy and quality of life adjustment levels, discount rates etc..

Estimated benefits used in the economic analysis
QALYs were reported discounted at 5% per year. For a lead-poisoned child who does not receive treatment the estimated QALYs were 18.25 years. The PROV strategy yielded 18.65 QALYs and prevented 8.8% of reading disability cases compared with no treatment. The EDTA and PCA strategies, both resulted in 19.27 QALYs, and prevented 22.5% of reading disability cases compared with no treatment. Side-effects were considered not relevant for patients with low level lead poisoning.

Cost results
The average projected cost of the no treatment strategy was $463 per child. The costs of PROV, EDTA and PCA strategies were $786, $1,778 and $2,032 per child, respectively. Costs of remedial education were $27,614.

Synthesis of costs and benefits
Incremental analysis was performed. The incremental cost-effectiveness ratios were as follows:

The incremental cost/QALY and cost/case prevented were: PROV vs no treatment - $ 804 and $ 3688 respectively;
EDTA vs PROV - $1597 and $7238 respectively; PCA vs no treatment - $1540 and $6986 respectively; EDTA vs no treatment - $1286 and $5855.

PCA vs EDTA showed that EDTA is more cost-effective, i.e., it yielded the same benefits as PCA but was less expensive.

The results of the model were sensitive to changes in the costs of treatment strategies, remedial educational costs and EDTA provocation testing results, and the effectiveness of chelation in reducing risk of reading disability.

When the lower costs (e.g., for outpatient care) of penicillamine chelation were considered, the EDTA strategy was less cost-effective than the PCA strategy; when higher costs of inpatient EDTA provocation testing and chelation were considered, the PCA strategy became more cost-effective. When costs of remedial education were considered, all strategies were cost-saving compared with no treatment.

When a 10% positive result (as against 35% in the base case) of EDTA provocation test was assumed, PCA strategy became more cost-effective than EDTA or provocation test strategies. Finally, if effectiveness of chelation was less than 12%, then the costs of medical treatment exceeded the costs of remedial education ($27,614). If the effectiveness was between 12% and 20%, then the costs of prevention with the EDTA strategy exceeded the cost of remedial education. If effectiveness was 20% or greater, the cost of remedial education exceeded the costs of preventing disability when EDTA strategy was compared with PROV strategy.

Authors' conclusions
The authors concluded that in the USA, chelation of pre-schoolers whose blood lead levels were high could prevent more than 45,000 cases of reading disability and saved more than $900 million per year in overall costs when costs of remedial education were included.

CRD Commentary
Effectiveness data were mainly based on authors' assumptions and the comparison between different strategies was sensitive to variations in the parameters.

If indirect costs of lead poisoning and its treatment were considered, the results of this analysis would be strengthened. As the authors themselves pointed out, possible effects of confounding factors like iron-deficiency anaemia and other medical and social conditions were not explicitly considered in the model.

Bibliographic details

PubMedID
7898292

Indexing Status
Subject indexing assigned by NLM

MeSH
Chelation Therapy /adverse effects /economics; Child, Preschool; Cost-Benefit Analysis; Decision Support Techniques; Decision Trees; Dyslexia, Acquired /economics /etiology /rehabilitation; Edetic Acid /economics /therapeutic use; Education /economics; Health Care Costs; Humans; Lead Poisoning /complications /diagnosis /economics /therapy; Models, Economic; Odds Ratio; Penicillamine /adverse effects /economics /therapeutic use; Quality of Life; Sensitivity and Specificity; Therapy, Computer-Assisted

AccessionNumber
21995005009

Date bibliographic record published
22/06/1995

Date abstract record published
22/06/1995