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 screening, before stimulant medication, using an electrocardiogram (ECG), to reduce the risk of sudden cardiac death in children with attention deficit and hyperactivity disorder (ADHD). The authors concluded that adding an ECG to screening might be cost-effective, especially when referral to cardiology was based on this alone. The benefits arose mainly from children avoiding competitive sports. The methods were valid and various areas of uncertainty were considered. The authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of screening, before stimulant medication, using an electrocardiogram (ECG), to reduce the risk of sudden cardiac death, in children with attention deficit and hyperactivity disorder (ADHD).

Interventions
There were three strategies.

In strategy one, a history and physical examination were performed and children were referred to cardiology if the findings were abnormal. This was the usual care.
In strategy two, a history and physical examination were performed, with an ECG if the findings were normal and referral to cardiology if either was abnormal.
In strategy three, a history, physical examination, and an ECG were performed and children were referred to cardiology only if the ECG was abnormal.

It was assumed that children who were diagnosed with heart disease did not initiate stimulant medication and did not participate in competitive sports.

Location/setting
USA/secondary care.

Methods
Analytical approach:
The analysis was based on a Markov simulation, with a 10-year horizon and a hypothetical cohort of seven-year-old children with ADHD. The authors stated that the analysis was carried out from a societal perspective.

Effectiveness data:
Most of the evidence was from cohort and observational studies. Some assumptions were made where there was no relevant published evidence. For example, the risk of sudden cardiac death, with stimulant medications, was based on authors’ assumptions. The accuracy of the screening strategies was the key input for the analysis.

Monetary benefit and utility valuations:
The utility values were from a study that assessed them using the standard gamble method, in the parents of children with ADHD.

Measure of benefit:
Quality-adjusted life-years (QALYs) were the summary benefit measure and were discounted at an annual rate of 3%. The number of sudden cardiac deaths was presented for each strategy.

Cost data:
Three main cost categories were considered; medications, medication-related visits, and patient or parent time for treatment. A breakdown of cost items was reported. The costs for physician services, ECG, and echocardiogram were from the 2009 Medicare Physician Fee Schedule and those for medication were from the 2008 Red Book. All costs were in US dollars ($) and a 3% annual discount rate was applied.

Analysis of uncertainty:
A Monte Carlo simulation was undertaken, using beta distributions, to examine if the base-case findings were robust. One-way sensitivity analyses were performed on all the individual variables, using published or arbitrary ranges of values. A two-way analysis was carried out varying the sudden cardiac death risk from playing competitive sports and the percentage of students playing them.

Results
The projected costs were $9,972 with strategy one (usual care), $10,024 with strategy two (usual care plus ECG if normal), and $10,010 with strategy three (ECG). The QALYs were 27.263413 with strategy one, 27.264682 with strategy two, and 27.264800 with strategy three. Compared with strategy one, the incremental cost per QALY gained was $39,300 with strategy two and $27,200 with strategy three. Strategy three dominated strategy two, which was less effective and more expensive.

The probability of being cost-effective, over strategy one, at a threshold of $50,000 per QALY was 55% with strategy two and 71% with strategy three. Strategies two and three avoided 13 sudden cardiac deaths per 400,000 people compared with strategy one; strategy three was cheaper than strategy two.

The sensitivity analysis showed that the low incidence of sudden cardiac death made the model sensitive to variations in the specificity of the ECG. Another influential input was the rate of participation in sport. The two-way analysis indicated that reductions in the rate of participation and the risk of sudden cardiac death significantly increased the cost per QALY for strategy two, while the findings for strategy three were more robust. Varying the risk of sudden cardiac death while on stimulant medication, had little impact on the results.

Authors' conclusions
The authors concluded that adding an ECG to the usual screening might be cost-effective, especially when referral to cardiology was based on the ECG alone. The benefits of the ECG were mainly gained through children avoiding competitive sports.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the conventional approach was compared against two proposed screening strategies.

Effectiveness/benefits:
Little information was provided on the derivation of clinical inputs for the model. The authors stated that most data were from cohort and observational studies, which have lower internal validity than randomised controlled trials. The details of these sources were not given and some assumptions were needed due to a lack of data, which means that an objective judgement of the data quality is not possible, but extensive sensitivity analyses were conducted on these inputs. The utility values were from parents of children with ADHD and were derived by a commonly used method. QALYs were a valid benefit measure and they capture the impact of the disease on a patient's health.
Costs:
A broad perspective was appropriately considered, given the relevance of productivity losses for parents of the children with ADHD. Most of the costs were presented as individual items and their sources were clearly reported. The cost estimates appear to have been treated deterministically, but the impact of variations in the assumptions was tested in the sensitivity analyses. Other details, such as the price year and discount rate, were given.

Analysis and results:
The results were clearly presented and a valid incremental analysis was used to synthesise the costs and benefits of the three strategies. The authors acknowledged some limitations of their study and these mainly related to the limited evidence for important model parameters. The uncertainty was satisfactorily investigated, using both a deterministic and a probabilistic analysis. The findings of these analyses were clearly reported and discussed. Conventional discounting was applied to both the costs and benefits and variation in the discount rate was considered in the sensitivity analysis.

Concluding remarks:
The methods were valid and various areas of uncertainty were considered. The authors’ conclusions appear to be robust.

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