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
The use of a teleconsultation service for children with cardiac pathologies. The service consisted of an offsite paediatric cardiologist in a tertiary care centre who visited, via the telemedicine equipment, children with cardiac pathologies who were in an acute care hospital located in a remote centre. The teleconsultation was set up to avoid transferring children to the tertiary care centre, which was a risky and expensive procedure. Also, to speed up the diagnosis and treatment of children suspected of having heart disease.

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised children suspected of having heart disease.

Setting
The setting was tertiary care and a clinic. The economic study was conducted in Canada.

Dates to which data relate
The effectiveness and resource use data were gathered from 1998 to 2001. The price year was not reported.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was conducted retrospectively on the same sample of patients as that used in the effectiveness study.

Study sample
The use of power calculations was not reported. A sample of all 78 consecutive children receiving teleconsultation from 1998 to 2001 at the study centre was included in the analysis. The mean age of the children was 2.4 years and 54% were boys. It would appear that no patient was excluded from the initial study sample for any reason. A single group of patients was used.

Study design
This was a retrospective within-group comparison study that was conducted in a single centre. No follow-up was conducted. The data were extracted from hospital charts then submitted, in a blinded fashion, to two physicians (a cardiologist at the tertiary centre and a paediatric physician at the remote hospital) for an assessment of the hypothetical management of these cases in the absence of the telemedicine service. Judgements were made independently and without knowing the patients’ identity or clinical outcomes after teleconsultation.

**Analysis of effectiveness**

All of the patients included in the initial study sample were accounted for in the effectiveness analysis. The primary outcome measure used was the number of patient journeys to the tertiary care centre that were avoided. The accuracy of the telemedicine service was also estimated.

**Effectiveness results**

The number of patient journeys was reduced by 42% with the teleconsultation service. Nine children (12%) seen by telemedicine avoided a transfer (patient air transportation), while 24 children (31%) avoided a visit to the tertiary care centre. Thirteen children (17%) were seen only by the telemedicine consultation. However, 7 patients (9%) needed a transfer and 4 children (5%) needed a visit to the tertiary care centre, despite having received the teleconsultation. Fifty-five patients were seen at the tertiary care centre after a prior teleconsultation. Without the telemedicine service, 62 patients would have been seen at the tertiary care centre.

In terms of the accuracy of the diagnosis, only 2 of the 55 cases available for comparison had different diagnoses determined via telemedicine and conventional consultation. However, the differences were minor and did not affect the reliability of the teleconsultation.

**Clinical conclusions**

The effectiveness analysis showed that the teleconsultation service was effective in reducing the number of visits to the outreach centre.

**Measure of benefits used in the economic analysis**

The summary benefit measure used was the number of patient journeys associated with each type of intervention. It was obtained directly from the effectiveness study.

**Direct costs**

Discounting was not relevant since the costs per patient were incurred during a short time. The unit costs and the quantities of resources used were not presented separately. The health services included in the economic evaluation were telemedicine equipment and fees, consultant services, patient transfers (aeroplane and patient's personal expenses) and patient visits to the tertiary care centre (only patient's personal expenses). Consultant services included telemedicine, outreach clinic visit, patient transfer, and visits to the tertiary care centre. It was assumed that the acquisition cost of telemedicine would depreciate over 5 years. The cost/resource boundary of the study was that of the patient and the health care system. The costs were estimated from the study hospital, while resource use was estimated using actual data derived from the sample of patients who were included in the effectiveness study. The data were estimated from 1998 to 2001 but the price year was not reported.

**Statistical analysis of costs**

The costs were not treated stochastically.

**Indirect Costs**

The indirect costs were not considered.
Currency
Canadian dollars (Can$). The exchange rates from Canadian dollars to US dollars ($) and Euros were Can$1 = $0.7 = Euro0.56.

Sensitivity analysis
One-way sensitivity analyses were conducted to assess the robustness of the estimated costs to variations in two cost drivers. The two cost drivers were equipment acquisition costs and telecommunication fees, and patient workload. The ranges used in the analysis were not reported.

Estimated benefits used in the economic analysis
The number of patient journeys was 11 with teleconsultation and 44 with conventional consultation.

Cost results
The estimated total costs over the entire study period were Can$272,327 for teleconsultation and Can$157,212 for conventional consultation.

Approximately 78% of the teleconsultation expenses were related to the acquisition cost of the telemedicine equipment.

The sensitivity analysis showed that the teleconsultation strategy remained the most costly, even when reducing the equipment acquisition costs and telecommunication fees by 50%.

Similarly, even when doubling patient workload over the 4-year study period, telemedicine was not cost-saving in comparison with conventional consultation.

Synthesis of costs and benefits
The costs and benefits of the two interventions were combined by calculating the average and incremental cost-effectiveness ratios.

The average cost per journey avoided was Can$3,573 with conventional consultation and Can$24,757 with teleconsultation.

The incremental cost per journey avoided with teleconsultation over conventional consultation was Can$3,488.

Authors’ conclusions
Teleconsultation was a reliable method for the diagnosis and early treatment of children with cardiac pathologies. However, the use of teleconsultation led to extra costs in comparison with conventional consultation, owing to the high initial acquisition cost of the equipment.

CRD COMMENTARY - Selection of comparators
The choice of the comparator (conventional consultation) appears to have been appropriate since it reflected the routine approach used for the management of children with cardiac pathologies. You should decide whether it represents a valid comparator in your own setting.

Validity of estimate of measure of effectiveness
The analysis of effectiveness used a within-group comparison study, which applied both diagnostic visits to the same series of patients. The use of a single group of patients avoided the need for an external control group. However, the comparison intervention was not actually delivered since two blinded physicians performed a hypothetical conventional visit. Therefore, in practice, the children received only the teleconsultation service. This represents a limitation because
it does not reflect real diagnostic patterns. The study was conducted in a single centre. Caution is therefore required when transferring the results to other settings. These issues could limit the internal validity of the analysis.

**Validity of estimate of measure of benefit**
The summary benefit measure was derived directly from the effectiveness study and represented an intermediate outcome measure. However, the authors justified their choice of such a measure, stating that it represented the main benefit of the study intervention and was strictly linked with the patients' health. The use of a measure comparable with the benefits of other health care interventions would have been helpful.

**Validity of estimate of costs**
The authors reported explicitly which perspectives were adopted in the study. Indirect costs, which would have been relevant to the patients' parents, were not included in the analysis. The price year was not reported, which was relevant since the costs were estimated for a 4-year timeframe. Therefore, reflation exercises in other settings would be difficult. The costs were treated deterministically, but some sensitivity analyses were conducted on key costs to assess the robustness of the estimated costs. The resource quantities were not reported separately from the costs. This limits the possibility of replicating the study.

**Other issues**
The authors compared their findings with those from another study that showed that telemedicine services for paediatric echocardiography only achieved cost-effectiveness after 9 years. Comparisons with other telemedicine services, namely teledermatology, were also made. The authors did not address the issue of the generalisability of the study results to other settings. The external validity of the analysis was therefore low, as very few sensitivity analyses were conducted only on the cost data. The study referred to children with cardiac pathologies and this was reflected in the authors' conclusions. Finally, it should be noted that the main cost driver was the acquisition cost of telemedicine equipment. Given that this is a fixed cost, the number of children who received this service per year and the assumptions about its depreciation appear substantial in the estimation of the cost per patient.

**Implications of the study**
The study results suggested that the implementation of telemedicine services is complex and requires substantial organisational efforts and changes. Therefore, long implementation times and high volumes of workload are required to ensure the cost-effectiveness of such programmes.

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