Teleradiology in a military training area
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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
The use of a teleradiology system (TRS), established in an isolated military training area (MTA), to assist medical providers with the management of cases characterised by uncertainty in diagnosis, treatment, or the degree of emergency of the case.

Type of intervention
Other: Support in diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised soldiers presenting to an aid station in an MTA with such medical conditions that medical providers were uncertain about diagnosis and treatment, or could not determine the urgency of the case.

Setting
The setting was primary care. The study was conducted in Hawaii, USA.

Dates to which data relate
Both the effectiveness and cost data were likely to have related to 2001, although this was not stated clearly.

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

Link between effectiveness and cost data
The costing was carried out prospectively on a sample of patients serving as the control group of the study. The costs for the intervention group consisted of operating and investment costs, and did not refer to each patient separately.

Study sample
No effectiveness data were derived from the study sample. Only qualitative data based on interviews with health professionals involved in the project were collected. The study was a pilot project that lasted 59 days. The TRS was available for 51 days during this period, so the study encompassed another 8 days during which the TRS was not available. In the 59 days of the study, 2,600 personnel were employed for an average of 17 days each, giving a total of 44,200 man-days. The TRS was available for 38,207 man-days.
Study design
The basis of the analysis was a pilot comparative study that was conducted in one site (an MTA). Since no effectiveness data were collected from the study sample, issues relating to follow-up were not applicable.

Analysis of effectiveness
The study did not measure any health outcomes directly. The number of soldiers who had been evacuated to Hilo Hospital was assessed. Health professionals involved in the study, including three military physicians, an independent duty corpsman and the radiographer, were interviewed. The interviewees’ views on the quality of care, access to care and resource savings when the TRS was available, and also their satisfaction and confidence with the system, were recorded. No primary measure of outcomes was used in the analysis.

Effectiveness results
During the time when the TRS was available, 32 cases were managed via the system (i.e. radiographs were transmitted from the MTA to the MMC). Only three of the 32 patients were evacuated (i.e. 29 evacuations were avoided). This represented an average rate of 0.57 per day or 0.76 per 1,000 man-days. During the time when the TRS was not available, 7 soldiers had to be transferred to the civilian hospital.

All interviewees agreed that the TRS improved patient care and saved money and time, as it prevented referrals to the civilian hospital. They were pleased with the response time for the radiology reports, which was generally less than one hour. The health care providers reported that the TRS increased their confidence in their diagnosis and treatment. The interviewees felt that the system helped them diagnose or exclude conditions with greater certainty.

Clinical conclusions
The authors stated that the TRS reduced the number of evacuations, resulted in better quality of care (determined by satisfaction of medical providers) and better access to care (determined by time to diagnosis and treatment), and increased the readiness of personnel (determined by average length of treatment).

Measure of benefits used in the economic analysis
No summary outcome measure was used in the economic analysis. The study was therefore characterised as a cost-consequences analysis.

Direct costs
The perspective of the study was not stated, but it was consistent with that of the military medical service provider. The costs of the TRS included operational costs (personnel, project management, training, miscellaneous supplies and maintenance) and investment costs. Training and investment costs referred to the first year of implementation, while maintenance costs were assumed to occur after the first year of use. Standard care costs in the absence of TRS consisted of evacuation costs (vehicle mileage, vehicle replacement, driver's time and mandatory assistant's time) and medical costs (hospital, X-ray and doctor's charges). The standard care costs and quantities were reported separately, based on actual data on cases managed when the TRS was not available. They were subsequently extrapolated for 1- and 5-year periods by estimating the number of expected evacuations within these timeframes. Details on the source and method of estimating the TRS costs were not reported. Discounting was undertaken, which was appropriate since the costs were estimated for a 5-year period, although the discount rate was not reported. The price year was possibly 2001, but this was not stated.

Statistical analysis of costs
The costs were treated deterministically. No statistical analysis of the costs was undertaken.

Indirect Costs
The indirect costs were not included in the economic analysis.

**Currency**
US dollars ($).

**Sensitivity analysis**
A sensitivity analysis was conducted to determine the expected rate of saved evacuations per 1,000 man-days of training below which the return on investment in the first year of the TRS use would fall to zero.

**Estimated benefits used in the economic analysis**
See the 'Effectiveness Results' section.

**Cost results**
The TRS cost $167,203 in the first year of use and $336,646 in 5 years ($349,940 undiscounted).

Standard care cost $176,540 in one year and $831,328 in 5 years ($882,700 undiscounted), based on an expected evacuation rate equal to 0.76 per 1,000 man-days of training.

The costs of standard care were expressed as savings arising from the implementation of the TRS.

The net present value of the TRS (savings minus costs) was $9,337 in the first year and $494,682 in 5 years.

The investment costs of the TRS were reported to be $128,617. Therefore, the return on investment was 7% in the first year and 385% in 5 years of use.

The sensitivity analysis showed that the rate of saved evacuations would fall to less than 0.57 per 1,000 man-days before the return on investment in the first year was reduced to zero.

**Synthesis of costs and benefits**
Not applicable since, in effect, the study was a cost-consequences analysis.

**Authors' conclusions**
The teleradiology system (TRS) was cost-effective as it led to a reduction in transportation, civilian hospital and possibly civilian air costs, and it provided savings in use of materials and man-hours. It also resulted in improvement in the quality of care at the point of need. In the opinion of the medical personnel interviewed, the project permitted improved diagnostic accuracy and greater diagnostic certainty.

**CRD COMMENTARY - Selection of comparators**
The selection of the comparator was implicitly justified since it represented standard practice. You should decide whether the comparator reflects widely used practice in your own setting.

**Validity of estimate of measure of effectiveness**
The basis of the analysis was a pilot comparative study. A randomised controlled trial would have provided a more robust study design. Effectiveness was measured using qualitative data derived from interviews with health professionals involved in the study. No safe conclusion on effectiveness can be drawn using this methodology. Moreover, health professionals' views were based on their personal experience within the 59 days of the project. It cannot be estimated whether the size of the patient sample treated within this period was sufficient to enable health
professionals to form a clear opinion on benefits resulting from the intervention.

**Validity of estimate of measure of benefit**
The authors did not derive a measure of health benefit. The analysis was therefore categorised as a cost-consequences study.

**Validity of estimate of costs**
The perspective of the study seems to have been that of the military medical service provider. All the categories of cost relevant to this perspective were included in the analysis. Some costs, such as costs associated with potential failure in diagnosis or treatment costs, were not included in the analysis. However, these were unlikely to have affected the authors' conclusions, unless effectiveness in diagnosis and treatment was significantly different between the two strategies. The standard care costs and quantities were reported separately, which improves the generalisability of the results pertaining to TRS savings. No statistical or sensitivity analyses of the costs were undertaken and this limits the interpretation of the study findings. Discounting was appropriately undertaken, as the costs were estimated for 5 years, but the discount rate was not reported. The year to which the prices referred was not explicitly stated and this may hinder the reproducibility of the results.

**Other issues**
The authors did not compare their findings with those of other studies. The issue of generalisability of the results to similar environments (geographically isolated MTAs) was addressed. The authors appeared to have presented their findings adequately. A limitation of the study is that the estimation of benefits was based on health professionals' experience with TRS and not on quantitative data taken directly from the study sample. The authors' conclusions were based on the assumption that TRS would be constantly available within the periods for which savings were estimated (1 and 5 years). However, TRS was not available for 8 of the 59 days of the study period (13.5% of the time) and the reason for this was not reported. If the TRS was frequently unavailable, then the savings and net present value of the system might be lower than reported. Despite these limitations, the study attempted an analysis of data derived from a small pilot project and the results confirmed the study hypothesis.

**Implications of the study**
The authors expressed the opinion that the project could be used as a model for future teleradiology work in similar environments. They suggested the system could serve as a prototype for the delivery of care in isolated MTAs.

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