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## **An economic analysis of a store and forward teledermatology consult system**

*Whited J D, Datta S, Hall R P, Foy M E, Marbrey L E, Grambow S C, Dudley T K, Simel D L, Oddone E Z*

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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**

A store-and-forward teledermatology (TD) service for patients referred for a dermatology consultation was examined. The consultant dermatologist reviewed a digital image and a standardised history, in addition to a text-based electronic request, and then evaluated whether to schedule the patient for a clinic-based evaluation or to relay a diagnosis and treatment plan back to the referring clinician.

### **Type of intervention**

Diagnosis.

### **Economic study type**

Cost-effectiveness analysis.

### **Study population**

The study population comprised patients referred for a dermatology consultation.

### **Setting**

The setting was secondary care. The economic study was performed in the USA.

### **Dates to which data relate**

All clinical and economic data referred to 2001 and were derived from a single study that had been published in 2002. The price year was not explicitly reported, but some costs were estimated in 2001.

### **Source of effectiveness data**

The effectiveness evidence was derived from a single study, the methods and results of which had already been published (Whited et al., see Other Publications of Related Interest).

### **Link between effectiveness and cost data**

The costing was carried out using a sample of patients that was larger than that used in the clinical study.

### **Study sample**

The study sample comprised 275 patients, of which 140 were in the UC group and 125 in the TD group. Other information on the study sample was not provided.

### **Study design**

The evidence came from a prospective, randomised clinical trial that was carried out at a single centre. Of the 110 TD

patients who were scheduled for a clinic visit, 21 (19.1%) did not present for their visit. One patient was not scheduled but showed for a clinic visit anyway. Of the 140 UC patients, 27 (19.3%) did not present. Further details on the study design were not reported.

### **Analysis of effectiveness**

The analysis of the clinical study used actual clinic visit data. These data were derived from clinic visit occurrences and accounted for no-show rates or non-compliance with clinic visit recommendations. The outcome measures used in the study were the following probabilities:

TD patient is scheduled for a clinic visit;

TD patient is not scheduled for a clinic visit but shows anyway;

TD patient is scheduled for a clinic visit and shows; and

UC patient is scheduled for a clinic visit and shows.

The number of patients evaluated annually in the dermatology clinic was also derived from the study hospital. The baseline comparability of the study groups was not discussed.

### **Effectiveness results**

The probability that a TD patient is scheduled for a clinic visit was 0.815 (range: 0.45 - 0.85).

The probability that a TD patient is not scheduled for a clinic visit but shows anyway was 0.04 (range: 0 - 0.10).

The probability that a TD patient is scheduled for a clinic visit and shows was 0.809 (range: 0.50 - 1).

The probability that a UC patient is scheduled for a clinic visit and shows was 0.807 (range: 0.50 - 1).

The number of patients evaluated annually in the dermatology clinic was 5,440 (range: 5,000 - 8,000).

### **Clinical conclusions**

The effectiveness analysis provided the probability values used in the model.

### **Modelling**

The authors stated that a decision model was constructed to estimate the economic and clinical impact of TD versus UC in the number of patients evaluated annually in the dermatology clinic. Exclusive use of TD was compared with exclusive use of UC. However, no details on the decision model were provided.

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

The summary benefit measure was the median time to the initial definitive intervention. This was obtained using a modelling approach.

### **Direct costs**

Discounting was not relevant as the costs were incurred during a short timeframe. The unit costs were not presented separately from the quantities of resources used for all items. The economic evaluation considered all costs associated with the TD service, clinic visit, and travel. The costs were grouped according to fixed and variable costs. The fixed costs included TD equipment and communication (T1 line). The variable costs consisted of digital imaging and review, clinic visit, and travel. The variable costs included mainly labour costs (including fringe benefits), but also space, overheads, supply, and travel.

The cost/resource boundary of the VA health care system was adopted. A micro-costing approach was used to assess each cost component. The source of the costs was not reported clearly for all items. Wages were derived from the Durham, North Carolina VA Medical Center Dermatology Consult Service. Resource use data were estimated from the study sample and then applied to the number of patients evaluated annually in the dermatology clinic (n=5,440). It was assumed that equipment would become obsolete in 7 years, thus a 7-year depreciation method was used to derive annual equipment and communication costs. The price year was not reported, but most costs were estimated in 2001.

### **Statistical analysis of costs**

The costs were treated deterministically.

### **Indirect Costs**

The indirect costs were not considered in the base-case but they were included in a sensitivity analysis. The average hourly wage was obtained from the US Bureau of Labor Statistics. It was assumed that a dermatology clinic visit would take a half-day off from work for the patient or a family member. The price year was 2001.

### **Currency**

US dollars (\$).

### **Sensitivity analysis**

Univariate sensitivity analyses were carried out to address the issue of variability in the data on all model inputs. Multivariate sensitivity analyses were performed on some key inputs. Alternative scenarios were also considered. For example, the T1 line was replaced using the Veterans Health Information Systems and Technology Architecture (VISTA) Imaging system, which would eliminate communication costs. Also, indirect societal costs were added to the estimated direct costs, and data from the intention to treat analysis were used in the estimation of clinical data. The ranges of values used were reported for all estimates, but the source of such ranges was unclear.

### **Estimated benefits used in the economic analysis**

In the base-case analysis, the median time to initial definitive intervention was 137.5 days for UC and 50 days for TD (p=0.0027). This resulted in an incremental effectiveness of 87.5 days. Variations performed in the sensitivity analysis did not alter substantially the base-case results, and the incremental effectiveness of TD ranged from 86 to 87.5 days.

### **Cost results**

In the base-case analysis, the annual cost of treating 5,440 patients was \$198,016 with TD and \$116,416 with UC. Thus, the average cost per patient was \$21.40 for UC and \$36.40 for TD.

The incremental cost per patient was \$15.

The sensitivity analysis showed that the incremental cost per patient did not vary substantially in the alternative scenarios (the incremental cost varied from \$10.50 to \$13.85). Similarly, unrealistic variations in the base-case model inputs were required for TD to be cost-saving over UC.

The two-way sensitivity analysis revealed that the three variables that showed the potential of having cost-savings thresholds (although at very extreme values) were the probability of a TD patient being scheduled for a clinic visit, clinic visit cost, and travel cost.

The inclusion of indirect costs did not alter the base-case results, although the TD costs were more comparable with UC costs.

### **Synthesis of costs and benefits**

An incremental cost-effectiveness ratio was calculated to combine the costs and benefits of the alternative diagnostic strategies. In the base-case analysis, the incremental cost per patient per day of time to initial definitive intervention saved with TD over UC was \$0.17. The results of the sensitivity analysis did not vary in comparison with the base-case results (ranging from \$0.12 to \$0.16 per patient per day saved).

### **Authors' conclusions**

The teledermatology (TD) service decreased the time to initial definitive intervention, but was more costly than usual care (UC) for a dermatology consultation. TD could be considered cost-effective in settings requiring long waiting periods for routine dermatological care.

### **CRD COMMENTARY - Selection of comparators**

The selection of the comparator was appropriate as it reflected the conventional approach to patient management. The authors made an extreme comparison in the model, because exclusive use of TD was compared with exclusive use of UC. Intermediate approaches were not considered. You should decide whether they are valid comparators in your own setting.

### **Validity of estimate of measure of effectiveness**

The effectiveness evidence came from a clinical trial, which was appropriate for the study question. However, the study had been published already and limited information on the methods, study sample and results was provided. The use of a randomised trial ensures a high internal validity. However, it was not possible to draw any conclusions on the robustness of the estimate measures, owing to the lack of information.

### **Validity of estimate of measure of benefit**

The summary benefit measure was specific to the intervention considered in the study and is not comparable with the benefits of other health care interventions.

### **Validity of estimate of costs**

The authors stated explicitly the perspective that was adopted in the study. Detailed information on the cost items included was provided, although the costs were presented as macro-categories. Therefore, the unit costs were not given. This reduces the possibility of replicating the analysis. Similarly, information on the source of the costs was limited for some items. Some costs were estimated in 2001 but the price year was not reported, which makes reflation exercises in other settings difficult. The costs were treated deterministically in the base-case, but extensive variations of the base-case costs were investigated in the sensitivity analysis. The indirect costs were also included in the sensitivity analysis and the method of calculation was explicitly reported. The authors noted that the variable costs could have been underestimated because the time spent by clinicians for other duties was not taken into consideration.

### **Other issues**

The authors reported the results of a prior economic evaluation of TD services and stated that contrasting conclusions had been reached. The issue of the generalisability of the study results to other settings was addressed by carrying out extensive sensitivity analyses, which enhances the external validity of the analysis. The authors noted that the study setting (a VA teaching hospital) could have introduced several potential biases against the TD service. These aspects were investigated in the sensitivity analysis, which showed that TD could be cost-saving in some scenarios.

### **Implications of the study**

The study result suggested that TD was more expensive than UC but, in some settings, TD could be considered a cost-effective alternative to UC. The authors stated that future large-scale studies are needed to better evaluate the cost-effectiveness of TD services.

**Source of funding**

None stated.

**Bibliographic details**

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**Other publications of related interest**

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Loane MA, Bloomer SE, Corbett R, et al. A randomized controlled trial assessing the health economics of realtime teledermatology compared with conventional care: an urban versus rural perspective. *Journal of Telemedicine and Telecare* 2000;7:108-18.

**Indexing Status**

Subject indexing assigned by NLM

**MeSH**

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