A randomized controlled trial assessing the health economics of real-time teledermatology compared with conventional care: an urban versus rural perspective


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
Real-time teledermatology care was compared with conventional outpatient care. Patients with dermatological conditions requiring a specialist referral from their general practitioner (GP) were evaluated through a hospital consultation, and were seen by the dermatologist in the outpatient department (conventional care) or through a teledermatology consultation in their local health centre. The patients were in the company of a GP and were seen by a hospital dermatologist over a video link. For this purpose, standard commercial videoconferencing units (VC7000, BT) connected by basic-rate ISDN lines (128 kbits/s) were used. An additional video-camera was connected to the videoconferencing unit at each health centre to enable the GP to transmit close-up images to the dermatologist.

Type of intervention
Other: Process of care.

Economic study type
Cost-effectiveness analysis.

Study population
Patients for the study were recruited from the general population. Patients with dermatological conditions requiring a specialist referral were invited to participate in the trial by their GPs.

Setting
The setting was primary and secondary care. The economic study was carried out in Northern Ireland, UK.

Dates to which data relate
The dates to which the effectiveness evidence and resource use data related were not reported in either this study or the parent study (Wootton et al., see Other Publications of Related Interest). The prices used related to 1995 for actual expenditure on equipment. Other price years were not reported.

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

Link between effectiveness and cost data
The costing was undertaken prospectively on the same sample of patients at that used in the effectiveness analysis.

Study sample
Details of the sample size calculations were reported in the parent study (Wootton et al., see Other Publications of
Related Interest). The study included 274 patients with a mean age of 39.7 years (standard deviation, SD=24.6), 44% of which were male. After randomisation, 126 patients (46%) had a teledermatology appointment and 148 (54%) had a conventional hospital appointment. Of the patients seen by telemedicine, 77 (61%) were registered with an urban practice and 49 (39%) were registered with a rural practice. Of the patients seen conventionally, 105 (71%) were registered with an urban practice and 43 (29%) were registered with a rural practice.

Study design
The study was a randomised controlled trial (RCT). It was performed in one regional hospital dermatology department that was linked to one urban and one rural health centre. The length of follow-up was 2 years. According to the parent study, the unit of randomisation was the patient. The method of allocation was through sealed envelopes with forms generated by a table of random numbers. Nine patients in the telemedicine group and 26 patients in the conventional care group were lost to follow-up.

In some instances there was no hospital record of the consultation in the patient's notes, so it was not known whether the consultation took place or whether the records were misplaced. Some patients required long-term follow-up, hence their medical records were incomplete at the time of data collection.

Analysis of effectiveness
The method of analysis used for the clinical study was not stated in either this study or the parent study (Wootton et al., see Other Publications of Related Interest). The primary health outcomes used were the number and type of consultations. These data were recorded by the dermatologist on a pro forma and a review of patient records was carried out. Patient re-attendance at either the GP surgery or hospital, and the actual clinical outcome of the initial consultation, were ascertained from a follow-up review of patient records. A minimum of 3 months elapsed before the patients' records were reviewed.

The comparability of the groups at baseline was not reported in either this study or the parent study.

Effectiveness results
A greater proportion of patients from rural areas, compared with patients from urban areas, had once-only visits to receive specialist care for their skin complaint. Rural patients seen conventionally had the highest proportion of once-only visits to the specialist (51%). Urban patients had higher hospital re-attendance rates compared with their rural counterparts: patients from rural areas seen by telemedicine had the least number of hospital re-attendance visits (41%).

Although patients seen by teledermatology made more return visits to their GP and hospital than patients seen conventionally, the difference was not significant, (p>0.05).

Irrespective of consultation type, patients from urban areas had more additional health care visits than patients from rural areas. The mean number of additional visits made by urban patients was 1.8 (SD=2.3), compared with 1.2 (SD=1.5) by rural patients, (p<0.01).

Clinical conclusions
The study found that almost half of the patients seen by telemedicine and conventional methods were managed by the GP following a single visit to the dermatologist. Fewer teledermicine patients were seen again at the hospital compared with conventional patients, although more were followed up by their GP. These findings indicate that the clinical outcomes of the telemedicine consultations and conventional consultations were similar. The pattern of health care use differed between patients in urban and rural areas. However, this difference may reflect a sampling effect due to the relatively small number of patients in rural groups.

Measure of benefits used in the economic analysis
No summary measure of benefits was produced. This study was considered as a cost-minimisation analysis as the
clinical outcomes were considered to be similar between the groups.

**Direct costs**
A cost analysis was performed from a hospital, a general practice and a patient perspective. The direct costs used in the study were grouped into fixed and variable costs. The fixed costs included all actual equipment, ISDN line installation and line rental costs paid out by each centre for the teledermatology service. The variable costs included the costs of GP and dermatologist time, patient travel, patient time involved in attending the initial appointment, and call costs. Marginal and average costs per patient were calculated. The marginal cost was considered to be the cost of doing one more consultation.

The quantities and the costs were analysed separately. These were estimated using actual data recorded during the 2-year period, and the date was not reported in the parent study. In relation to the source of the data, the patients completed an anonymous economic questionnaire assessing the costs incurred by them immediately after their initial consultation and following the first return visit to hospital. The cost of patient time was estimated from the average annual income of all patients. The average accrued savings for teledermatology consultation over 2 years were included in the societal perspective. The clinicians were interviewed to obtain quantitative data on the costs and benefits of teledermatology. Although no discounting was undertaken, it would not have been relevant as the costs were during a 2-year period. A standard interest charge of 6% per annum was applied on the capital equipment.

The costs were corrected for learning effects of the new technology, by considering the benefits related to a reduction in dermatological referrals by an average of 20% in the first year and 10% in the second year. The benefits resulted from the interaction and learning benefits derived from GPs being present at the teledermatology consultations. These benefits were estimated by the GPs.

The price year used for actual expenditure on equipment was 1995.

**Statistical analysis of costs**
The resource use was treated stochastically and one series of unit costs was used. The authors did not report if any statistical tests were carried out.

**Indirect Costs**
The indirect costs (due to reduced economic productivity) were not included in the analysis.

**Currency**
UK pounds sterling (£). No conversion was undertaken. The exchange rates mentioned in the study for reference purposes were 1 = Euro 1.57 and US$1.46.

**Sensitivity analysis**
The sensitivity analysis was intended to show the effect of different assumptions on the unit costs. The areas of uncertainty investigated were related to variability in the data and extrapolation from primary data to make the results more comprehensive. One-way sensitivity analyses and a scenario analysis were carried out, but the method used to select the ranges was not reported. The parameters evaluated were an increase in patient travel distance, the purchase of equipment at year 2000 prices, and a "real world" scenario. The real world scenario included:

- equipment purchase at 2000 prices;
- depreciation costs paid over the lifetime of the equipment;
- ISDN line rental paid for 7 years;
- 10 patients seen per morning session, over 45 working weeks per annum;
a reduced rate used for clinician time; and

a 20% reduction in outpatient referrals.

**Estimated benefits used in the economic analysis**
Not applicable.

**Cost results**

From a hospital perspective, the observed cost of a teledermatology consultation was 6,865, compared with the cost of 5,406 for a conventional consultation. The marginal cost per patient was 26.41 for the teledermatology consultation versus 36.53 for the conventional consultation.

From a general practice perspective, the observed cost of a teledermatology consultation was 6,973 in urban areas and 5,849 in rural areas. The marginal cost per patient was 24.95 in urban areas and 27.24 in rural areas.

From a patient perspective, the observed cost of a teledermatology consultation was 448 in urban areas and 220 in rural areas. The observed cost of conventional consultation was 857 in urban areas and 782 in rural areas. The marginal cost per patient of the conventional consultation was 24.95 in urban areas and 27.24 in rural areas.

From a societal perspective, the total cost of a teledermatology consultation in urban areas was 11,279, compared with the cost of 4,949 for a conventional consultation. The total cost of a teledermatology consultation in rural areas was 8,831, compared with 2,097 for a conventional consultation. The observed marginal cost per patient of the teledermatology consultation was 52.85 in urban areas and 59.93 in rural areas. The observed marginal cost per patient of the conventional consultation was 47.13 in urban areas and 48.77 in rural areas.

The authors performed an incremental analysis as follows. The study calculated the average consultation cost per patient, the marginal costs of an additional consultation and total net costs. There was little difference (1.64) between the marginal costs of urban and rural patients seen conventionally, while there was a bigger difference (7.08) in the marginal costs for urban and rural patients seen by telemedicine.

A key factor affecting the costs was the travel distance between the health care providers and patients.

The total cost of the telemedicine consultation was higher than the conventional alternative for both the urban and rural patients.

From the patient perspective, telemedicine was cheaper than conventional care as it involved less travel and time costs. From the hospital perspective, telemedicine was only marginally more expensive than conventional care when current equipment prices were used in the calculations. Indeed, from the hospital viewpoint, the marginal cost of the telemedicine consultation was lower than that of the conventional consultation when current prices were used.

The sensitivity analysis using a real-world scenario showed that in urban areas the average cost of telemedicine and conventional consultation were about equal, while in rural areas the average cost of telemedicine consultation was less than that of conventional consultation.

**Synthesis of costs and benefits**
Not applicable. The study was considered a cost-minimisation analysis.

**Authors' conclusions**
Following specialist advice over a video-link, almost half of the telemedicine patients were managed within primary care. The proportion of patients requiring an additional hospital appointment was comparable to the number of conventional patients who needed a further hospital appointment. The costs of providing a teledermatology service were
not prohibitive, although the financial benefits were more likely to accrue to the patient (especially in rural areas) than to the health service provider. From an educational perspective, the benefits derived from real time medicine consultation enabled the general practitioner (GP) to provide effective dermatological care to the benefit of all patients, which improves the overall standard of health care.

**CRD COMMENTARY - Selection of comparators**
A justification was given for the comparator used. Teledermatology was compared with the actual process of care, in which patients were seen by the dermatologist in the outpatient department. You should decide if the comparator represents current practice in your own setting.

**Validity of estimate of measure of effectiveness**
The basis of the analysis was an RCT, which was appropriate for the study question. Although an RCT was conducted, no statistical analysis was carried out on the clinical outcomes. In addition, the method used for the analysis of the clinical study was not stated. The authors did not report how representative the study sample was of the study population, or the comparability of the patient groups. These facts limit the internal validity of the study.

**Validity of estimate of measure of benefit**
The authors did not derive a measure of health benefit and reported equal benefits for the two groups. The analysis was therefore categorised as a cost-minimisation analysis.

**Validity of estimate of costs**
Although the authors reported that the costs were estimated from several perspectives, not all of the costs were included. Some costs and benefits were omitted from the analysis, such as those stated in the parent study. For example, physical, social and psychological impact on the patient of the skin complaint being resolved sooner rather than later, and the effect of long waiting lists on patient morale and ultimately patient health. Also, the avoidance of paying interim treatments while waiting for specialist appointment, greater convenience to the patients of being seen at their local health centre, and enhanced GP job satisfaction. Further omissions were equipment maintenance and repair, training staff to use the equipment, and the costs of return visits. Some of the omissions could affect the magnitude of the study conclusions, such as equipment maintenance and repair, which would make the new technology even more expensive. However, reducing time off work could increase the cost-effectiveness of the new technology from a societal perspective.

The costs and the quantities were reported separately, which will increase the generalisability to other settings. The resource use quantities were taken from several sources and no statistical analysis of the quantities was performed. Sensitivity analyses were performed, although the reasons for the ranges chosen were not reported. The prices (unit costs) were taken from several sources and no statistical analysis of the prices was reported. This limits the interpretation of the results. With the exception of equipment purchase, the date to which the prices related was not reported. This will prevent any possible inflation exercises.

**Other issues**
The authors did not compare their findings with those from other studies. The issue of generalisability to other settings was partially addressed through a "real world" scenario. The authors appear to have presented their results selectively. The authors’ conclusions reflect the scope of the analysis since their objective was to measure the cost-effectiveness (cost-minimisation analysis of real-time teledermatology, compared with conventional outpatient dermatology care, for patients from urban and rural areas. The authors reported a further limitation of the study in that the economic patient data for the conventional care group were obtained from a questionnaire with a low response rate.

**Implications of the study**
Although the authors did not make any specific recommendations for practice or policy, recommendations were made
in the parent study (Wootton et al., see Other Publications of Related Interest). Teledermatology is more expensive than conventional consultation, mainly due to the cost of equipment and GP time. It becomes more cost-effective when patients have to travel greater distances to the hospital. The education of GPs in joint consultations done by telemedicine could reduce the number of future referrals.

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**Bibliographic details**


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**Other publications of related interest**


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