Authors' objectives
To assess telemedicine services that substitute for face-to-face medical diagnosis and treatment and that might apply to
the Medicare population.

Searching
MEDLINE was searched for relevant publications up to November 2004; the search terms were reported. In addition,
the reference lists of selected studies and relevant systematic reviews were checked.

Study selection
Study designs of evaluations included in the review
The authors did not state any inclusion criteria relating to the study design. A wide range of study designs were selected
for inclusion, ranging from randomised controlled trials to case series.

Specific interventions included in the review
Studies that focused on telemedicine services that would substitute for face-to-face medical diagnosis and treatment,
including store-and-forward, home-based self-monitoring/testing or office/hospital-based services, were eligible for the
review. Excluded were studies of services not requiring face-to-face encounters and telephone or e-mail care
programmes. A wide range of telemedicine interventions were evaluated in a range of settings:

store-and-forward telemedicine was evaluated in dermatology, gastroenterology, gynaecology, ophthalmology and
wound care;

office/hospital-based services were evaluated in cardiology, neurology, dermatology, ophthalmology, psychiatry,
rheumatology, vascular surgery, critical care, orthopaedics, otolaryngology and wound care.

Participants included in the review
Studies including patients in the Medicare population were eligible for inclusion. Studies of children and pregnant
women were excluded from the review. The interventions were evaluated in a wide range of populations: home-based
self-monitoring/testing was evaluated for congestive heart failure, chronic disease in the elderly, coronary artery
disease, diabetes mellitus, hypertension, lung transplantation, multiple sclerosis, spinal cord injury, obesity, psychiatry
and pulmonary disease.

Outcomes assessed in the review
Studies reporting the comparability of diagnostic decisions and recommendations for clinical management,
comparability of health outcomes, and access to care were eligible for inclusion. The outcomes reported in the included
studies were relevant to their particular setting.

How were decisions on the relevance of primary studies made?
Two reviewers independently selected each study for inclusion in the review.

Assessment of study quality
The included studies of clinical outcomes were classified according to their level of evidence (i.e. study design). In
addition, for studies of diagnostic and management decisions, features of the study design which were likely to be
associated with bias, such as small sample sizes (less than 10 to 20 patients), selective application of definitive diagnosis
testing, and insufficiently long follow-up to determine diagnosis when a 'gold' standard test was not or could not be
performed, were evaluated. One reviewer performed the validity assessment and a second reviewer checked it.
Data extraction
One reviewer extracted the data and a second reviewer checked the extraction.

Methods of synthesis
How were the studies combined?
The studies were combined in a narrative.

How were differences between studies investigated?
The studies were presented in the narrative synthesis according to the type of telemedicine intervention being evaluated (store-and-forward, home-based self-monitoring/testing, office/hospital based services) and the type of outcomes reported (diagnosis and management, health outcomes, access). Further differences between the studies were apparent from the tables and were discussed to some extent in the text of the review.

Results of the review
One hundred studies (number of participants unclear) were included in the review.

Store-and-forward telemedicine (35 studies).

Diagnosis or management: the largest number of studies came from the specialty of dermatology, in which concordance varied widely, from 41 to 87% for complete agreement and from 51 to 96% for disease-category agreement. While one study found complete agreement in decision to biopsy, others found lesser concordance. Diagnostic accuracy studies typically compared telemedicine diagnosis with a 'gold' standard, often biopsy of a pigmented lesion. In these studies, telemedicine generally was nearly as good as face-to-face in terms of a correct diagnosis. Wound care studies demonstrated that some characteristics of skin wounds and ulcerations could be assessed effectively using store-and-forward telemedicine, though these studies lacked statistical power. Four out of 5 ophthalmology studies showed that a high accuracy of diagnosing diabetic retinopathy could be obtained.

Health outcomes: there were no studies that assessed health outcomes using store-and-forward telemedicine interventions.

Access to care: 5 studies reported evidence on the effect of store-and-forward techniques upon access to care. The methodological quality of these studies was generally low and it was not possible to draw any firm conclusions.

Home-based telemedicine (27 studies).

Diagnosis or management: 2 studies assessing diagnostic capabilities in the home in the areas of congestive heart failure assessment and pulmonary function monitoring found various levels of agreement and disagreement, depending on the specific observation.

Health outcomes: the studies were highly heterogeneous and had several limitations. Multifaceted interventions demonstrated more benefit than single interventions such as monitoring of blood sugar or blood-pressure. In most studies, it was not possible to assess whether improved outcomes were due to the increased level of care provided by dedicated clinical staff or to the telemedicine intervention.

Access to care: no studies were identified that examined the effect of home-based telemedicine services on access to care.

Office/hospital-based telemedicine (38 studies).

Diagnosis or management: the most frequently studied specialty was ophthalmology; other frequently studied specialties included neurology and psychiatry. The results demonstrated that some diagnostic assessments could be successfully administered via telemedicine.

Health outcomes: studies indicated that outcomes with telemedicine interventions were comparable to those using
conventional clinical evaluations. However, most of these studies were limited by small sample sizes and/or other problems.

Access to care: methodologically weaker studies suggested that office/hospital-based telemedicine improved access to care for patients in rural locations in medical applications in which patient evaluations could be performed using standard teleconferencing equipment.

Authors' conclusions
There are still significant gaps in the evidence base for the efficacy of telemedicine interventions.

CRD commentary
This review was based on a question that was broadly defined in terms of the participants, interventions and outcomes. An electronic database search was supplemented by checks of the reference lists from relevant systematic reviews and primary studies. However, MEDLINE was the only database searched, no attempts were made to identify unpublished studies, and it was unclear whether the search was restricted by language. For these reasons, the possibility that relevant studies might have been overlooked cannot be excluded. The validity of the included studies was assessed by a variety of ways and multiple reviewers were employed at every stage to minimise the potential for errors and bias. Given the heterogeneity of the included studies, the use of a narrative synthesis was appropriate and the authors' conclusions were appropriately cautious.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that, in teledermatology, larger and more comprehensive analyses are needed to assess key patient outcomes; there is also a similar need for studies of clinical outcomes using office/hospital-based telemedicine in fields such as psychiatry and neurology. The authors added that well-designed randomised controlled trials would provide valuable information on the potential of these clinical applications; longitudinal observational studies and demonstration projects would also be useful. Finally, studies of home-based telemedicine should address the independent contributions of technology and human resources in complex interventions for patients with chronic diseases.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.