Telemedicine: Why the Delay?

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The use of information-based technologies and communications systems to deliver healthcare across geographic distances is termed telemedicine. Indeed, the history of telemedicine is the history of communications technology, specifically the advances made in this field in the second half of the 20th century. The practice of medicine through telecommunications as we know it today was born in the early 1960s when NASA (the U.S. National Aeronautics and Space Administration), sending its first animal and human astronauts into space, was challenged by the problem of how to monitor their health status and provide them with medical care. The tremendous technical progress of the last 40 years has made telemedicine increasingly possible, as evidenced by the yearly twofold increase in the number of active telemedicine programs in the United States since the early 1990s [1]. However, despite the rapid advances and dissemination of information technologies in our daily life, the use of telemedicine remains restricted rather than widely deployed. This can be attributed to various obstacles and concerns, the major one being the yet unanswered question of the cost-effectiveness of telemedicine systems.

As telemedicine became more popular in recent years, its varied clinical applications also increased. Today, telemedicine can be used for medical consultations, diagnosis, medical and patient education, and even for the performance of surgical procedures. In recent years the services most used in clinical applications, based on the number of teleconsultations conducted annually, are in the field of psychiatry, cardiology and dermatology [1]. Apart from consultations, the most widely deployed and established telemedical service is teleradiology, which involves the transmission of medical images to the radiologist for interpretation. Another field that has shown rapid growth and potential is in-home medical care and patient monitoring. Telemedicine technology can replace Holter-based monitoring systems [2], and can be used to improve diabetes care by registering and transmitting glucose measurements to the physician [3]. In the field of surgery, telemedicine has been used for some years as intraoperative video-conferencing for consultations or medical education. It can be used as a means to screen surgical candidates without them having to travel to the surgical center. And lately, robotically mediated telesurgery has made it possible for surgeons to operate at a considerable distance from the operating room [4,5]. Overall, regardless of the service provided, telemedicine systems are used especially in rural areas as a means of easing the accessibility problem of specialist advice and treatment.

In this issue of *IMAJ,* Klaz et al. [6] describe the Israel Defense Forces experience with a teledermatology program aimed at improving health services provided by primary care physicians in rural and urban clinics. Summarizing their findings, Klaz and team conclude that implementing a computerized teledermatology service provides efficient and high quality medical service. The authors' methodology was based on patient and user satisfaction and perception of healthcare quality. This report reinforces what is already known about teledermatology and demonstrates the increasing interest in telemedicine as a legitimate healthcare service in Israel.

Before routine adoption of any new technology, it must be shown to be superior to the current alternatives. In attempting to evaluate telemedicine services we must first decide on the evaluation methods. Indeed, published reports describe numerous different evaluation methods that measure both clinical and non-clinical outcomes. Clinical outcomes can be grouped into three categories: clinical effectiveness (i.e., reduction in morbidity or mortality), patient satisfaction, and diagnostic accuracy of telemedicine versus non-telemedicine. Non-clinical outcomes include cost benefits, technical outcomes (such as quality of medical images) and management outcomes (such as time savings).

In reviewing the literature, only a few published articles measured the clinical effectiveness of telemedicine programs compared to standard healthcare methods. As an example of one of these studies, Whitlock and collaborators [7] describe and measure standard clinical outcomes in diabetes mellitus patients by means of a home telemedicine consultation program. Using the telemedicine program, these researchers found a significant reduction in both body mass index and hemoglobin A1c. A more common evaluation tool that also addresses clinical outcome is patient satisfaction. Although measuring satisfaction has its drawbacks as a reliable healthcare quality indicator, it has become an accepted and popular method. While most patient satisfaction studies report a relatively high satisfaction with telemedicine services, only a few of these studies actually compared telemedicine with conventional healthcare services and most were not large-scale studies [8].

The most common method used to evaluate new medical

technologies, including telemedicine, is to compare the diagnostic accuracy versus conventional diagnostic methods. Most of the studies evaluating telemedicine compared the clinical accuracy of digital images used to reach a diagnosis, mainly in radiology, dermatology and pathology. Indeed, most of these studies show a high correlation between the traditional and telemedicine methods. In a meta-analysis of published trials of telepathology, the authors found strong evidence for a diagnostic accuracy comparable to that of glass slide diagnosis [9]. Several studies compared face-to-face dermatologic consultations with teleconsultations performed using low cost video-conferencing equipment or digital cameras. Most of these studies found a high diagnostic accuracy, with clinically relevant disagreement occurring in only 4–8% of cases [10–12]. Overall, these studies conclude that telemedicine is an accurate and clinically reliable diagnostic method, but add that further experience and additional investigation will improve our ability to determine which specific clinical conditions are more suitable for telemedicine.

Though many studies evaluating telemedicine have been published, they describe widely differing systems, in a wide range of applications, and with diverse organizational contexts. Furthermore, most of the studies are small in scale, with only a few being controlled trials. In an attempt to study the evidence for the effectiveness and economic efficiency of telemedicine, several large meta-analyses were conducted. Roine and associates [13] identified 50 articles out of 1,124 that were considered by the authors as having high scientific quality. Most of the published articles identified refer to pilot studies and short-term outcome trials that cannot be considered high quality. When analyzing data from selected articles, the authors conclude that evidence for clinical effectiveness was found for some applications, such as teleradiology and consultations between primary and secondary healthcare providers. Economic analyses of these trials suggest that only teleradiology can be considered cost-saving. The authors stress that high quality scientific evidence on the evaluation of telemedicine is still limited. A more recent evaluation by the same group found that although recent data were added concerning new telemedicine applications, good quality studies are still scarce, and that the reports of clinical or economic benefits essentially confirmed previous findings [14].

Indeed, what about the cost benefits of telemedicine programs? A large systematic review published in the *British Medical Journal* in 2002 evaluated data from 55 studies that presented actual cost-benefit outcomes, of which only 24 met quality inclusion criteria [15]. The authors conclude that there is insufficient published evidence to unequivocally confirm that telemedicine is a cost-effective alternative to standard healthcare delivery. Furthermore, when reviewing published cost-analysis studies, none of the studies used the cost-utility analysis – considered the most appropriate method for telemedicine as it includes quality factors (i.e., quality of life) in addition to quantitative clinical effectiveness. The lack of such studies makes it impossible to draw clear conclusions on whether telemedicine is a cost-effective means of delivering healthcare.

Without a doubt, these questions on the clinical and economic effectiveness of telemedicine constitute a major obstacle to the widespread implementation of telemedicine by healthcare organizations. Moreover, there are several other obstacles that have to be overcome before new methods and technology can be introduced. These include technical and logistic restraints, organizational resistance, and psychological barriers – all crucial factors that require further study.

In conclusion, given the rapid advances in technology in general and telecommunications in particular, the long-term prospect for telemedicine is very good. It is therefore surprising that such a promising field is bound by barriers that have yet to be overcome. The fact that there is presently no convincing evidence that telemedicine is a cost-effective means of delivering healthcare should emphasize the need for better designed large-scale trials. Ten years ago, an anonymous editorial in *The Lancet* stated: "although much is claimed, the economic benefits of telemedicine have yet to be proved" [16]. Unfortunately, that still holds true.

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