



## Broadcast Quality Teleconferencing for Oncology

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### ABSTRACT

The National Cancer Institute (NCI) in Bethesda, Maryland has developed a broadcast-quality teleconferencing system known as the Telesynergy™ system to address the need to convey expert information between larger cancer centers and their remote counterparts. This system is available to “Partnerships in Science Program” partners across the U.S. Recently, it has been made available in Ireland under a “Memorandum of Understanding” among the Department of Health and Children of Ireland, the Department of Health and Social Services in Northern Ireland, and the NCI. The Telesynergy system is capable of transmitting not only broadcast-quality teleconferencing among several different sources, but also diagnostic-quality

radiology and pathology images. Remote operated microscopes and video cameras allow biopsy specimens to be discussed and manipulated from several different locations. Smear preparations of blood, bone marrow, and other cytological specimens can be examined in detail by a remote operator. The system can also transmit conventional x-ray images and paper documents. The Telesynergy system ensures that each patient, regardless of location, will receive an expert assessment and be given optimal therapy. While the system is currently being developed in Ireland for use in oncology, it is hoped that other specialties can benefit from it in the future. *The Oncologist* 2001;6:459-462

### INTRODUCTION

A major challenge in the development of modern oncology services lies in ensuring that each patient receives an expert assessment and is given optimal therapy. The oncologist working in a remote location has difficulty in accessing the expertise available in the large cancer centers because the nuances of clinical information are difficult to convey to the expert at the center. The conventional printed information in letters or e-mails lacks visual detail and is not amenable to expert review. Standard videoconferencing offers very poor resolution images, which may suffice for general discussion but fall far short of diagnostic quality when transmitting pathology or radiology images. This has been addressed at

the National Cancer Institute (NCI) in Bethesda, Maryland, where specialist broadcast-quality communication has been built into their Telesynergy™ teleconferencing system. They are making this available to their “Partnerships in Science Program” partners across the U.S. They have also been eager to extend this across the Atlantic to Europe and recent developments in their collaboration with centers in Ireland have facilitated this process.

In October 1999, the Parliament Buildings at Stormont in Belfast, Northern Ireland, were the venue for the signing of a landmark “Memorandum of Understanding” among the Department of Health and Children of Ireland, the Department of Health and Social Services in Northern

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Ireland, and the NCI of the U.S. Department of Health and Human Services.

On the strength of the Memorandum, the Northern Ireland Cancer Centre at Belfast City Hospital, Belfast, Northern Ireland, and Saint Luke's Hospital, Dublin, Republic of Ireland, became the first hospitals outside the U.S. to participate in a Partnership in Science™ collaborative effort with the Division of Clinical Sciences of the NCI. The Partnerships in Science™ Program is a pilot program designed to combine the educational, research, and clinical talents of the staff of the NCI's Division of Clinical Sciences. It facilitates a collaborative research bridge with physicians and other health care colleagues in a limited but representative number of premier research and health care facilities in the U.S. and globally.

The three participants in the Memorandum of Understanding have made a commitment to work together in the treatment of cancer. They have established a multilateral partnership to intensify cooperation in cancer studies and to improve scientific programs within their jurisdictions. Projects were undertaken in epidemiology, basic science, clinical research, and education, and in information technology.

The information technology projects included the development of the net-Trials clinical trials system and the implementation of the Telesynergy communications package. The NCI and the Center for Information Technology of the U.S. National Institutes of Health have developed this fully featured broadcast-quality telemedicine package. This complex and comprehensive telemedicine system will link all participating centers in the Partnerships in Science™ Program enabling data and images from different sources (Table 1) to be shared and discussed for a range of different professional applications (Table 2).

### THE TELESYNERGY SYSTEM

In practical terms, the Telesynergy suite requires approximately six meters of bench space. It must also be located in a secure room with sufficient seating for those involved in the activities. The system has a broadcast-quality teleconferencing facility, which can transmit information and images from several different sources. In addition to standard teleconferencing, diagnostic quality radiology and pathology images can be transmitted. Two high-resolution monochrome image display systems each function as an Electronic View Box (EVB) for the display of full-size (14 × 17 inch format) "electronic films." Utilizing the EVBs, organ and lesion contouring, for example, is performed via a shared-cursor technique in consultation mode, which allows the clinicians to collaborate in identifying features by outlining them. These identified regions-of-interest

**Table 1.** Summary of Telesynergy facilities

- Broadcast-quality video conferencing
- Diagnostic radiology images
- Pathology review
- Remote control facilities for microscope
- Radiotherapy planning
- Clinical image viewing
- S-video studies
- Digitization of manual notes and x-ray films
- E-mail

**Table 2.** Uses of Telesynergy

- Clinical case conferences
- Grand rounds
- Expert case review
- Multicenter radiotherapy planning
- Clinical management protocol development
- Distance learning
- Seminars
- Patient screening for clinical trials
- Non-oncology applications

are viewed simultaneously and in real-time among all Telesynergy sites participating in the consultation session.

The remote-controlled Olympus microscope AX70 together with video camera and remote-control module U-MCB allows biopsy specimens to be discussed and manipulated from a number of sites concurrently. The microscope is suitable for formalin fixed paraffin embedded sections and ultra-thin plastic embedded sections. Smear preparations of blood, bone marrow, and other cytological specimens can be examined in detail by a remote operator. The suite also has a digitizer for the transmission of conventional x-ray film images and paper documents. S-video recorded images can be transmitted for review of studies such as echocardiography and dynamic ultrasound. In addition, a patient examination camera allows high-resolution views of dermatological lesions, skin coloration, and other physical signs during a patient examination. Other additional add-ons to Telesynergy are currently being developed: Color Duplex Ultrasonography, a virtual examination glove, and endoscopically assisted ultrasound.

The Telesynergy medical imaging workstation is designed for use within an electronic imaging environment, utilizing an Asynchronous Transfer Mode (ATM) telemedicine network. It provides for the simultaneous high-resolution display of medical images from numerous sources. The

Telesynergy suite is modular and is ideally replicated at each site (Fig. 1). Microphones and speakers allow bidirectional voice communication and, video capability is provided with S-video cameras and monitors. The audio and video information from digital diagnostic equipment is fed into Telesynergy at the host site, and the data streams are transported continuously through a 155 Mbits/sec ATM link that connects the NCI and the off-campus Partnership sites. If ATM capability is not available at a Partnership site, a high-speed 1.5 Mbits/sec ISDN telephone circuit can be used, with some degradation in audio and video quality. The system is complex and technically advanced and will demand ongoing technical support. The combined demands of the broadband telephone link and the requirement for technical support will result in significant running costs.

### PRACTICAL EXAMPLE

It is envisaged that multicenter sessions (with participants from the NCI, Dublin, and Belfast, as well as other institutions) will be arranged for case review of complex patient problems. For example, a patient with a newly diagnosed lymphoma may present to the Belfast City Hospital for evaluation and treatment. Belfast City Hospital doctors, in the process of the patient evaluation, can make a fully interactive case presentation using the Telesynergy system to other doctors at the participating centers.

The case presentation can include a standard computer-based text slide presentation and review of medical images of all types, including the pathology slides, or review of the x-rays, computed axial tomography scans, and magnetic resonance imaging (MRI) with other participants. All centers can participate actively. This includes taking full control of the microscope to highlight pathology features for discussion. Detailed consideration can be given to difficult and challenging biopsies. This will be particularly valuable in the lymphoma field since several independent audits have shown that the diagnosis when reviewed by expert panels is altered in up to 18% of cases, and treatment decisions are altered as a result of the modified diagnosis in 6% of cases. Likewise the radiology images can be discussed with areas of interest being highlighted by a different cursor from each participating center.

If radiotherapy were contemplated, the radiation oncologists may consult on the identification and delineation of the target and treatment volumes for radiotherapy prior to the development of a treatment plan, during the evaluation of that treatment plan, or discuss the patient's progress during the treatment course. Radiotherapy treatment planning is very well supported, as this was the initial area in which this system was developed.

The case conference is therefore highly interactive with pooling of expertise, and it facilitates the development of common evidence-based treatment protocols and their application to individual patients.

### FUTURE DEVELOPMENT

The Belfast City Hospital is currently installing the Telesynergy system, and it is already being installed in Dublin. The key area of use will be in oncology but the facilities are obviously well suited to use in other medical specialties. As the Telesynergy system has been developed, other areas of application for which it is suited have been identified. These include cardiology, nuclear medicine, otolaryngology, ophthalmology, dermatology, mammography, histopathology, and other specialties such as vascular surgery and upper gastrointestinal cancer surgery.

As an example, the regional vascular surgical service at the Belfast City Hospital, is eager to implement the Telesynergy system. They use endovascular techniques in the management of complex vascular problems particularly in the thoracic aorta and in patients who would otherwise be unsuitable for open vascular repair. Present imaging techniques including formal angiography, computerized tomography scanning, and MRI imaging could be transmitted to fellow participants, ensuring a wide range of professional advice and consultation. Decision-making for those problems arising from the less common aneurysms of the thoracic aorta would be facilitated. It is also envisaged that in vivo transmission of images during the actual therapeutic interventions could facilitate refinement of information exchange and building of combined expertise.

Belfast City Hospital oncologists can now form part of an integral team with partners in Dublin and in the U.S. in evaluating the patient's physical state, investigative results, and responses to therapy. The Telesynergy system and the combined clinical expertise will facilitate the delivery of optimal clinical care to patients, and this is



Figure 1. The Telesynergy suite at the NCI.

envisaged as an innovative method of enhancing the adoption of uniformly high standards of care. The Telesynergy system is the first concrete project with clear clinical benefits for patients to emerge from the “Memorandum of

Understanding.” We are eager to evaluate the system to assess whether the practical limitations of timing and coordinations can be overcome to drive forward this exciting new concept.