# A Bridge Between Academic and Community Radiation Oncology Treatment Planning

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## Abstract

**Purpose:** To evaluate Telesynergy (TS) as a method of interactive treatment planning between academic and community radiation oncology departments.

**Methods:** Through a grant from the National Cancer Institute to improve cancer outcomes for underserved populations, community radiation oncologists at New Hanover Regional Medical Center (NHRMC) in Wilmington, North Carolina, partnered with those at the University of North Carolina (UNC) in Chapel Hill, North Carolina. TS suites were installed at both sites to facilitate teleconferencing and review of treatment planning for intensity-modulated radiation therapy (IMRT). Patients with locally advanced head and neck cancer at NHRMC who were enrolled on a clinical trial of chemoirradiation underwent IMRT planning utilizing commercial software. NHRMC physicians contoured tumor targets and adjacent healthy organs. Physics staff at NHRMC generated an initial IMRT plan for each patient. Radiation oncologists at UNC then reviewed individual IMRT plans via TS conferences.

**Results and Conclusion:** Between August 2004 and August 2005, seven IMRT plans were reviewed in eight TS conferences. Physician contours of tumor targets and healthy organs, dose volume histograms, IMRT beams, and isodose distributions were shared during each TS conference successfully. Median time for each session was 35 minutes (range, 30 to 75). Physician satisfaction with the interactive planning process was high at both NHRMC and UNC. A cycle would likely evolve of initial intensive use of TS conferences, to gradual use for ongoing quality control, then greater use as the treatment planning technology undergoes its next change. Complex IMRT treatment planning review was feasible between an academic and community hospital via TS with a high level of physician participant satisfaction.

## Introduction

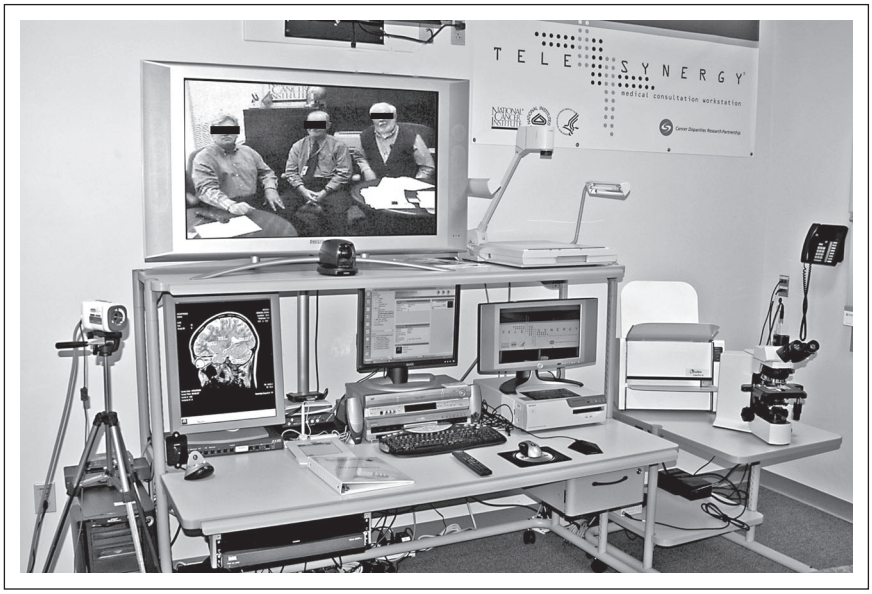
In an effort to reduce differences in cure rates for common cancers between the general population and various underserved groups, the National Cancer Institute awarded six major cancer disparities research partnership (CDRP) grants between 2002 and 2003 to radiation oncology departments in community cancer centers throughout the country. Each awardee partnered with an academic mentor institution in an effort to improve cancer care for underserved patients in the community. New Hanover Regional Medical Center (NHRMC) in Wilmington, North Carolina, received one of these CDRP awards with its chosen academic partner, the University of North Carolina (UNC) in Chapel Hill, North Carolina, for a project entitled, Improving Cancer Outcomes for African Americans in Southeastern North Carolina. A major component of each grant was the installation of Telesynergy (TS) suites at both community and academic sites for teleconferencing, teleconsultation, and potential technology transfer for complex radiation treatment planning. This technology allows full video conferencing and exchange of images relevant to the clinical planning process. The ability to simultaneously display a variety of medical images makes it suitable both for learning how to implement new technologies at the community level and as a means of quality control during and after the implementation of these technologies.

In southeastern North Carolina, head and neck squamous cell carcinoma (HNSCC) remains a prevalent disease largely due to the pervasiveness of tobacco use and carcinogenic effects on the upper aerodigestive tract. Radiation therapy plays a dominant role in the care of these patients. Cure with organ preservation and minimal toxicity is the goal. Data from academic radiation oncology departments indicate the potential to decrease treatment-related toxicity with the use of intensity-modulated radiation therapy (IMRT) for HNSCC.[1,2] IMRT is a complex method of delivering therapeutic radiation that usually incorporates multiple beamlets within each radiation beam in order to increase dose to tumors and decrease dose to healthy surrounding organs, thus improving the therapeutic ratio. However, IMRT utilization and expertise for the treatment of HNSCC in the community varies widely and results are largely unpublished. We report our initial experience with TS as a method of interactive IMRT planning for the treatment of patients with advanced HNSCC between a university and a distant regional community hospital.

## Methods

Each TS suite is a stand-alone telemedicine workstation. As designed by the National Cancer Institute, components include a personal computer hub, two monitors for incoming and outgoing video, microphones, microscope to show pathology slides, radiology film scanner, document camera, and patient camera to show lesions on physical examination (Fig 1). Connectivity for the system is primary rate integrated services digital network. After installation by the National Cancer Institute staff, NHRMC staff added a second computer to connect to the local area network. The suites at both UNC and NHRMC were

**Figure 1.**




then connected to their respective hospital Picture Archiving Communication systems in order to share digital radiographic images. Finally, radiation treatment planning software was connected to the TS suite at NHRMC, after obtaining the necessary licensure.

Patients with stage III and IVa HNSCC were seen and examined at NHRMC. Eligible patients were enrolled on ZCC 00204, a clinical trial testing the efficacy and toxicity of a novel chemoirradiation regimen. The institutional review board at NHRMC reviewed and approved the ZCC 00204 protocol. In addition, patient consent was obtained for TS plan review with UNC. All patients underwent IMRT planning utilizing commercial software. NHRMC physicians contoured tumor targets and adjacent healthy organs. Physics staff at NHRMC then generated initial IMRT plans on the ADAC treatment planning system. Treatment planning data was shared between the TS suites at NHRMC and UNC for review of IMRT plans.

## Results

Eight TS treatment planning conferences were held to review IMRT plans for seven patients. The summary of TS conferences is presented in Table 1. The first patient's plan required two sessions for adequate review. Median time for each patient's session was 35 minutes, with a range of 30 to 75 minutes. The first four patients required a mean TS time of 60 minutes, while the final three patients averaged 30 minutes each. Data was successfully shared during all TS conferences including: axial computed tomography images containing multiple physician contours of tumor targets and adjacent healthy organs, IMRT beam arrangements, isodose distributions, and dose volume histograms for both targets and healthy organs. Radiation oncologists from UNC recommended significant changes to planning target volume (PTV) contours for the initial patient's plan. The magnitude of change in PTVs was not measured. Two other patients' PTVs were changed to a lesser degree. The other four case reviews resulted in no changes to PTVs. No changes were recommended to healthy organs or beam arrangements for any of the seven plans.

While no formal metric was utilized to gauge TS participant satisfaction, physicians at both academic and community radiation oncology departments were pleased with respect to efficiency of data sharing and clinical efficacy of distant interactive IMRT planning. The fact that plans were modified in three of seven patients is strong evidence that worthwhile information was obtained from the interaction.

## Discussion

The field of radiation oncology is a discipline of cancer care that relies heavily on image review and the use of advanced technology for the development and implementation of appropriate treatment plans. It incorporates aspects of both oncology and radiology. The physicians must understand patterns of likely disease spread for each individual tumor presentation, and be able to identify relevant structures and tumor extent from a variety of imaging modalities. Most academic radiation oncology centers that have telemedicine capabilities currently utilize the equipment for three main purposes: teleconferencing, quality assurance, and remote treatment planning.

Teleconferencing for educational purposes appears to be utilized in radiation oncology in a similar fashion to other medical disciplines. Often these conferences may be to broadcast a lecture from a visiting expert oncologist. In other institutions, multidisciplinary tumor boards are held utilizing telemedicine

**Table 1. TS Review of IMRT Planning for Head and Neck Cancer**

| Patient No. | No. of TS Conferences | Duration (minutes) | Plan Changes |
|---|---|---|---|
| 1 | 2 | 65, 65 | PTV1, PTV2, PTV3 |
| 2 | 1 | 35 | None |
| 3 | 1 | 65 | PTV1, PTV2 |
| 4 | 1 | 75 | PTV1, PTV2 |
| 5 | 1 | 30 | None |
| 6 | 1 | 30 | None |
| 7 | 1 | 30 | None |

Abbreviations: TS, Telesynergy; IMRT, intensity modulated radiation therapy; PTV1, high-risk planning target volume; PTV2, intermediate-risk planning target volume; PTV3, low-risk planning target volume.

to include health care providers who may be practicing at distant sites.

Another role for telemedicine in radiation oncology departments is for quality assurance. Perhaps the largest scale utilization in this regard is reported from German lymphoma studies.[3] Patients treated at universities in Cologne, Berlin, Munich, and other cities across Germany had digital radiotherapy portal films reviewed centrally, in an effort to minimize deviations from standard lymphoma protocols. Other groups have utilized telemedicine for quality assurance at their regularly scheduled patient chart reviews among various centers.[4,5] Investigators have also used transfer of digital treatment planning information to validate treatment plans for patients on national cooperative group clinical trials using facilities such as the Quality Assurance Review Center.

Because many academic radiation oncology departments consist of a central hub with multiple satellites in a network, teleradiotherapy has emerged as a method of remote treatment planning. Most institutions appear to be creating treatment plans at the university center, then transferring data to surrounding community hospitals so that patients may be treated closer to home.[6-8] Ogawa et al reported their experience with plan transfer for practical purposes of routine and emergent radiotherapy, as well as for resident education.[9]

To our knowledge, this report is the first in the medical literature to describe interactive IMRT planning. The basic premise is similar to review of standard radiation therapy plans via telemedicine. However, review of IMRT plans requires the successful sharing of data that are significantly more complex and voluminous than that required for other methods of radiation therapy planning. In addition to high resolution computed tomography images, the TS suites allowed for clear review of tumor targets and healthy adjacent organs that the treating physicians had contoured onto the axial images. Complex beam arrangements and isodose distributions were easily shared as well. Physicians at NHRMC were pleased with the interactions because radiation oncologists at UNC critiqued IMRT plans prospectively. Any proposed changes could be implemented before initial treatment. The UNC physicians were pleased with TS as an effective mode for teaching and interactive planning as well.

There are two potential drawbacks to utilizing telemedicine for IMRT plan review: time and money. In this small series, the learning curve for contouring target volumes by community physicians at NHRMC was fairly rapid. The initial few TS conferences averaged 60 minutes, while the final three sessions averaged 30 minutes. However, some may argue that even 30 to 60 minutes is a significant amount of time in a hectic clinic schedule.

When one considers utilizing TS to review IMRT plans for more common disease sites than head and neck cancer, the time sink could be even greater. At the time of this study, NHRMC physicians already had significant clinical experience with prostate IMRT, so they felt little need to review these plans via TS. At NHRMC, three to six new patients per week start IMRT for prostate cancer. Intradepartmental review of these IMRT patients in dosimetry takes approximately 30 minutes per week. Review of these same patients via TS would likely require 40 to 60 minutes weekly; perhaps longer for clinicians with less experience. Thus, while it may be intellectually stimulating to review all IMRT patients (eg, prostate, head and neck) on a weekly or monthly basis between a community and an academic center, the time required may be prohibitive. Once the initial learning curve has reached its plateau for a practicing radiation oncologist in the community, a reasonable approach thereafter might be to present only the most challenging patients on a weekly or monthly basis to the academic partner for review.

The financial pressures against implementing TS or other teleradiation oncology system are twofold. While guidelines exist to reimburse medical experts for telemedicine consultation in clinical patient care, we are unaware of any parameters to reimburse for review of radiation therapy plans. In radiology, medical insurance carriers pay for outside reviews of diagnostic studies. It would not be a stretch to extend this line of thinking (and payment) to academic review of radiation therapy plans. Many community hospitals will be unable (or unwilling) to pay for initial equipment, up-fitting of existing facilities, monthly telecommunications, and other recurring costs, particularly in light of a questionable financial return on investment.

Given these considerations as well as our experience, one could design an approach to optimize the use of this interaction. During the early development phase of new technology into the community center, regular and extensive interaction between institutions could be employed. The workload of the community physician could actually be reduced by providing rapid feedback regarding potentially major errors. The trial and error approach that is unfortunately often employed in individual centers could be avoided. Building on the experience of the academic center in this manner could thus save time and money, as well as assure a higher quality of care.

As the community physicians become more facile in the use of the new technology, the exchange could be performed as a periodic quality control measure. The expectation is that the time employed during this type of review would be far shorter. Also, the process might aid in regulatory reviews requiring outside audits of practice patterns. The use of TS would ideally evolve in step with the evolution of practice patterns.

The potential future applications and benefits of telemedicine in the field of radiation oncology are many. Education may be greatly enhanced for both residents and practicing physicians in the community. Judging from our experience, the learning curve for contouring tumor targets is rapid. Radiation oncolo-

gists at major academic centers may share their IMRT planning expertise with physicians in the community on a broad scale via telemedicine. Patient care will clearly be enhanced from this sharing of complex technology and knowledge.

In conclusion, TS has provided an effective link between an academic and a distant community radiation oncology department. Complex IMRT plans were reviewed in an efficient and clinically beneficial manner. Physician participants at both ends were highly satisfied with the interaction.

***Acknowledgment***

*Supported by Cancer Disparities Research Partnership Grant No. NIH RFA CA-03-018 from the National Cancer Institute.*

***Authors' Disclosures of Potential Conflicts of Interest***

*The authors indicated no potential conflicts of interest.*

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DOI: 10.1200/JOP.0752001

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