Use of CERR at the Quality Assurance Review Center to Assess Protocol Compliance of Radiation Therapy Treatment Plans Submitted in Digital Format

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QARC
QUALITY ASSURANCE REVIEW CENTER

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Background: The Quality Assurance Review Center (QARC) is funded by the NCI to provide radiotherapy quality assurance (RTQA) for several cooperative groups (ACOSOG, CALGB, COG, ECOG, PBTC, and SWOG). CERR (Computational Environment for Radiotherapy Research) is an open source application written in the Matlab programming environment for viewing and analyzing radiotherapy data. CERR is easily customizable and has many of the features of a modern 3D treatment planning system for visualization and analysis of treatment plans. With its capability of importing and displaying data sets in either RTOG format or DICOM RT, CERR is ideally suited for use in reviewing treatment plans from diverse planning systems. For this project CERR has been extensively customized for use as a review tool to assess protocol compliance of radiation therapy treatment plans submitted in digital format to QARC.


Materials/Methods: Data arrives at QARC by either secure FTP (SFTP) or CD and is transferred to a Windows PC on the QARC network for processing. A network concurrent license for Matlab enables use of CERR by all users on the local network. With a network license, use of CERR is also enabled remotely by connection to a terminal server through a web browser. CERR studies are linked to the patient's record in the QARC database so they can be easily launched while reviewing a case.

Among the many useful features of CERR are:
- Import of both RTOG and DICOM RT data (CT, structures, plan, dose and DVH's)
- Display of three orthogonal views
- Multiple panel layouts
- Dose display in isodose or colorwash mode
- Dose summation or subtraction
- DVH calculation and display
- Structure contouring
- Contour expansion and Boolean operations
- Multi-modality image registration
- Anonymization of studies

DVH parameters are easily calculated within the CERR viewer.
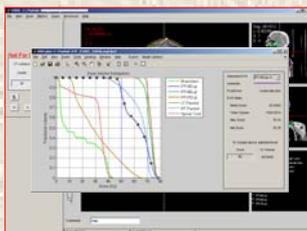
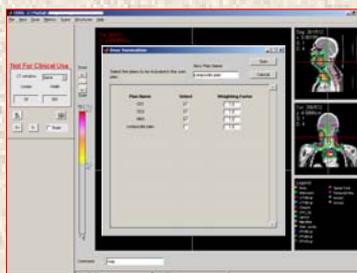Modifications and enhancements made to CERR for QARC use include:

- A command line to launch a CERR study from the patient's record in the QARC database
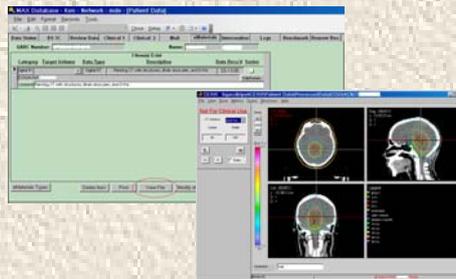
- Import of additional plans to an existing study (subsequent phases of treatment and/or modified plans)
- Separate function for DICOM imaging import
- Import of DICOM imaging to an existing study
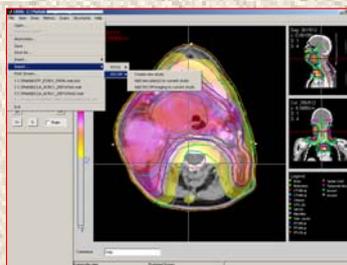
- Import of multiple structure files for DICOM RT (omitting duplicate structures)
- Dose summation of multiple (>2) dose distributions

- A simple display of beam parameters (both RTOG and DICOM RT data)
- Improvement in import speed for DICOM RT
- Multiple consistency checks applied during the import process and when changes are made within the viewer

Modifications and enhancements made to CERR (cont.):

- Implementation of DVH import for DICOM RT data
- An export function to export DVH data to a delimited text file for further analysis

Results: CERR has been integrated into QARC's process for acquisition, display and analysis of digital RT data, which has required addition of several new features and modifications. In its first 18 months of use, more than 300 protocol cases and 140 benchmark cases have been processed. Digital data has been received from more than 100 institutions, using thirteen different planning systems, representing both RTOG and DICOM RT formats. Development of this project is continuing with the support of the Advanced Technology Consortium (ATC).

| Planning systems with full data sets successfully imported into CERR ||
DICOM RT	RTOG
Eclipse	Pinnacle
Variseed	XiO
Plato	Theraplan Plus
XiO	Corvus
Oncentra Masterplan	UMPlan
Helax	
IsoGray	
Konrad	
Memorial Planning System	

Conclusions

The increasing use of new modalities such as IMRT and IGRT makes the use of full 3D data sets essential for accurate assessment of radiotherapy treatment plans. CERR provides a powerful, customizable toolset for these applications, and has been extensively modified and fully integrated into the QARC review process.