***An automated system to streamline clinical workflow, plan review and QA for Radiation Therapy***

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**Purpose:**

To implement an automated system to streamline clinical workflow at a proton therapy center. Many routine clinical operations that have direct impact on patient care are often time consuming and resource intensive. One example is the treatment planning review process, which requires rigorous dose volume analysis and often manual extractions of dose statistics. This process is typically iterated several times until the dose plan is acceptable. Our goal is to identify and automate such operations by implementing a clinic-wide system composed of specialized software components. The components perform routine clinical operations with accuracy and efficiency, improving overall clinical operation and efficacy.

**Methods and Materials:**

The dose analysis is routinely used to evaluate the quality of a treatment plan. Dependent on the disease site and treatment protocol, customized dosimetric forms are used to evaluate the quality of the dose plan through a laborious manual process (Fig. 1).

This automated system is built upon the RCET[1] architecture developed at our institution. The RCET system has recently been extended to fully support DICOM ion plans. The passive forms are replaced with server-based active forms. The active forms contain all data and formula needed for plan dose analysis. A proper active form is auto-generated at each step of the plan review.

Fig. 2 shows an overview of our system design. Proton plans that are ready for review are exported from the Varian Eclipse planning system into our RT-PACS system via the network. DICOM objects including the image sets, RT structures, RT Plans and RT Dose are automatically analyzed and required data are extracted and stored in a central clinical database. In the case of the plan dose analysis, the the required data consist of prescriptions, dose volume histogram statistics and dose constraints for the target volumes, and organs at risk.

Upon selection of the disease site and clinical protocol, the system uses the associated templates to generate specific active forms. These forms are stored in the SharePoint server, which is a central repository. The formula in the active forms use the embedded data to self validate. For example, appropriate check boxes on the form are marked depending whether the dose constraints are met or not (Fig. 3).

The reviewed electronic forms are then cascaded to the next step in the workflow and consumed by the anticipated role actors. Notifications or special triggers (such as task list or quality checklist) can also be launched as designed to ensure completion of the clinical process with optimum expediency.

**Results and Conclusion:**

We have successfully implemented a system that automates the dose analysis process during plan review. Customized electronic dosimetric forms are auto-filled by triggering embedded applications as one goes through the clinical workflow. Such automation improves accuracy and optimizes clinical efficiency and efficacy. Similar auto-generated active forms can be designed to automate monitor unit modeling and calculation, physics QA, etc. to improve the clinical workflow. Fig. 4 depicts the conceptual model of integrating clinical workflow.

[1]Palta J, Frouhar V, Dempsey J. Web-based submission, archive, and review of radiotherapy data for clinical quality assurance: A new paradigm. International Journal of Radiation Oncology, Biology, Physics 57: pp 1427-1436, 2003

**Figures:**

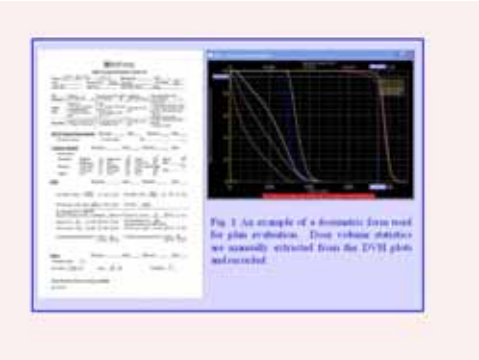

Figure 1

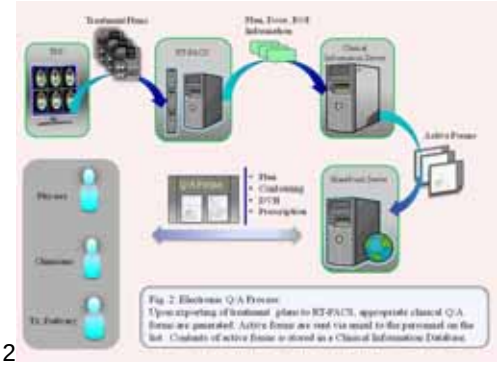

Figure 2

Figure 3

Figure 4