AbstractID: 14310 Title: Change-based Image Quantification for Tailoring Radiation Therapy and Chemotherapy to Individual Patients

Purpose: Most image quantification formats and processes are not applicable to the full spectrum of physiologic and molecular imaging modalities, do not facilitate a wide range of clinical decision-making, and do not calculate treatment-induced subvolumetric (intratumoral) changes while maintaining subvolume spatial integrity. A robust system of software tools has been developed to address these deficiencies and facilitate image-based tailoring of treatment for individual patients.

Methods and Materials: New software tools enable the construction of 3D “isonumeric contours” from voxels from biological and molecular image sources (MRI, MRSI, PET, SPECT). Series of 2D and surface contours, representing separate narrow intensity value ranges, are rendered for multi-dimensional display of tumor molecular and/or physiologic topography. A software-based model for applying change to clinical practice has been designed.

Results: Automatically-measured volumetric and subvolumetric topographic parameters include volume, surface area, shape, inter-contour distances, median and peak intensity values within contours, number of intra-tumor (subvolumetric) "elevations" (analogous to conventional topography elevations), elevation height (difference between an elevation’s base contour and peak intensity values), etc. Pre- and post-treatment contour changes are quantitatively assessed, and change values are compared to a database of pre-determined values for which outcomes are known. The odds of a given outcome can be quantitatively estimated. Rules engine-based treatment recommendations can be made, and rules engine-based volumetric and subvolumetric target contours can be defined.

Conclusion: Software has been developed for quantitative assessment of treatment-induced changes in tumors and tumor subregions, including change-based predictions and recommendations. The system will enable early recognition of tumor subvolume responses, based on minimal subvolumetric changes, to facilitate early, clinically relevant changes in chemotherapy administration or radiation therapy targeting and dosing. The system may also facilitate biologically matched differential dose delivery within tumors, based on early recognition of tumor and subvolume radioresistance.

Conflict of Interest: Research sponsored by ImQuant, Inc.