New Developments in Knowledge Based Planning and Automation

Setting the Stage for Incorporation of Toxicity Measures in Treatment Plan Assessments

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• What is normal?

• How did we do in treating our patients?

Periodic Cleveland Clinic report (~83 pages) provided to physicians to give detailed data on outcomes for all disease sites.

Example of how routine collection of data can be incorporated into clinician discussions of evidence based medicine and used as a baseline to better inform patients.

Requires a commitment to "follow the data".

The world that we're working toward living in

Simulated dataset of 2,000 patients – single institution

NTCP Metrics would be routinely calculated and analyzed

Toxicities would be routinely measured and compared to DVH and NTCP metrics

DVH Metrics would be routinely aggregated and analyzed for all patients

Simulated dataset of 20,000 patients – multiple institutions
The clinic is busy, tools are limited, so try out comparison for a small group of patients. Intensely manual!

More serious about the question, mount a research study. Again tools are limited so intensely manual.

Simulated dataset of 20 patients

Simulated dataset of 200 patients

How will our clinic be able to gather “Big Data”?

• Technology is a much smaller step than culture changes needed for implementation: consensus (inter and intra institutional), process, changes in work duties, QA

• Can do a lot with existing treatment planning and radiation oncology information systems

• Think through what data elements you want/need in the long run, how they are related and then develop a strategy of small, manageable steps.

How to get there?

Technology

• Software/database systems for aggregating information
• Software system for reports
• Integration with other systems

Culture

• Need to shift thinking about data related to treating our patients.
• Thinking about the data not just for treatment of the patient before us, but for systemic aggregation to help all the patients yet to come.
• Implication is accepting limitations in options, standardizations
• Potentially more work to quantify data – “free text” is hard to use

A few options here

• DIY – use in-house staff with expertise or train
• Use consultants to help build
• Purchase from current vendor (ROIS, TPS)
• Purchase from 3rd party vendor

This…only you can do

Assume you have the technology, what do you have to do to make your practice to enable the technology to get the data?

• Consensus in your practice
• Standardize practice
• Change who does what

Baby Steps — a list of them

To move a group you have to help them believe in the vision.

As you create working examples that show it is real and doable, then they will lead the way.

Pick working examples that can positively impact workflow in clinic and add value to current practice

Identify and tackle the “enabling” steps one by one. This positions you to grow your effort.
Be sure to fully enter and curate your diagnosis and staging data, primary and metastatic. These are key to the majority of common questions you'll want to ask later.

Application becomes our standard prescription.

Also serves as documentation tool for imaging setup, notes, IMRT justification, etc.

Physician groups define consensus for DVH metrics for all treatment sites, what to measure and default values for constraints and prioritizations.

Several groups are coordinating efforts to address nomenclature for radiation oncology:

**AAPM Task Group No. 263 - Standardizing Nomenclature for Radiation Therapy**

Merges, unifies, standardizes of data elements - coders, vendors, institutions, institutional, academic, academic, medical, physicians, other.

**NRG Oncology**

AAPM Task Group No. 263 - Standardizing Nomenclature for Radiation Therapy
What is normal?
Simple Tangents
Heart Doses

Mean(Gy)
Practice change here for Tangents only

V4Gy[%]

V25Gy[%]

Diarrhea : Black: Grade 0, Red: Grade 1

Comparing toxicity to DVH metrics
When is no data, data and when is it just no data?

- Almost all of the 0 scores correspond to not entering a value.
- Another iteration on changing culture to think about treatment records as like a scientist as well as like a clinician.

- Need to enter the data, all of it
- Need to perform QA on the data

- Change your culture to think about treatment data as something you will want to aggregate and analyze over the long term, not just what you have to do to treat the patient
- Think in terms of 1000's not 10's of patients. Real knowledge implies real numbers.
- Standardize processes, nomenclatures, etc so that computers can automatically extract the information
- Be sure to use the tools in your planning and record and verify systems to make data extracted reliable for answering clinical and research questions