



RO-ILS Celebrates 2022 International Day of Medical Physics

In carpentry there is a proverb to ‘measure twice and cut once.’ This same principle applies to radiation oncology where checks and double checks promote plan accuracy and equipment function before treatment is delivered. Medical physicists are key members of the radiation oncology team who perform critical functions of reviewing plan and measurement information.

In the following good catch example, a medical physicist reviewing a 4-D CT scan identified incorrect contours that occurred upstream in the planning process.

- A patient with cancer in the left lower lung and previous treatment to the mediastinum was simulated with a 4-D CT.
- The radiation oncologist completed contouring with two potential target areas delineated as “xGTV” and “CTV.”
- A dosimetrist sought clarification and the physician informed the dosimetrist that “CTV” was the target and “xGTV” was an automatically generated contour from a PET scan and not a target.
- The dosimetrist requested a physics review of the scan.
- The medical physicist noticed during their review that:
 - The “CTV” contour extended into the previously treated area.
 - The “xGTV” contour correlated directly with an area of high uptake on the PET scan.
- This caused the physicist to seek clarification from the radiation oncologist and it was found that the high PET uptake area that had been labeled as “xGTV” was the intended target for the current treatment and that the “CTV” contour was actually a contour of the previously treated area.
- The physician corrected the contours and renamed appropriately.

Great Catch Physics!

This event highlights the importance of:

1. Clear documentation and acknowledgement of previous treatment information.
2. Standard naming convention, aligned with American Association of Physicists in Medicine (AAPM) TG 263¹ when possible. At a minimum, the terms gross tumor volume (GTV), clinical target volume (CTV), and planning target volume (PTV) should be reserved for current target structures only.²
3. Effective team communication, with empowerment of team members to discuss planning concerns.
4. **Medical physicists review!**

It is not universally practiced for physicists to review 4-D CTs at the beginning of treatment planning. However, given their complexity and the potential for error, it may be beneficial to identify cases where earlier review may be beneficial. In a study of approximately 200 patients requiring stereotactic radiotherapy, 23% of cases required a change in patient management (e.g., rescan of 4-D, change in margins/contours) after an independent review of the 4-D scan by a medical physicist.³

SAFETY CHECK

**In your practice's workflow, when and how are 4-D scans reviewed by medical physicists?
What other tools does your practice have to catch this error earlier in the workflow?**

With a primary responsibility of quality assurance, it is no surprise that medical physicists are often at the helm of quality and safety initiatives such as RO-ILS. They are most likely to serve in the leadership role as “PSO Liaison” for their practice and participate in events such as RO-ILS User Meetings. Additionally, they are the second leading group of discoverers of errors, based on the events reported to RO-ILS. Physicists are also key partners in incident learning on the national level, including serving on the Radiation Oncology Healthcare Advisory Council to review events and develop education for the community and users. The program's foundation was formed out of a partnership between AAPM and American Society for Radiation Oncology (ASTRO) as co-sponsors of RO-ILS, highlighting the leading role physicists played in establishing the program. With the help of other supporting specialty societies and vendors, U.S. practices are able to participate in the program for free, allowing learning to be shared openly with the radiation oncology community.

¹Mayo CS, Moran JM, Bosch W, et al. American Association of Physicists in Medicine Task Group 263: Standardizing Nomenclatures in Radiation Oncology. *Int J Radiat Oncol Biol Phys.* 2018;100(4):1057-1066.

²Existing recommendations of TG 263 do not specify how to denote contours from a previous treatment. This may be an area of possible exploration and consideration for the updated report that is in progress.

³Antony R, Lonski P, Ungureanu E, et al. Independent review of 4DCT scans used for SABR treatment planning. *J Appl Clin Med Phys.* 2020;21(3):62-67.