# SNMMI $^{177}$Lu Dosimetry Challenge 2021

The SNMMI Dosimetry Task Force, which has a primary goal of advancing the use of dosimetry in applications of radiopharmaceutical therapy, announced on February 12 the launch of the SNMMI $^{177}$Lu Dosimetry Challenge 2021. The community-based science challenge responds to the need for harmonized methods for internal dosimetry. Despite multiple efforts to standardize internal dosimetry, resulting recommendations have been at various levels of completeness, and implementation of recommended dosimetry procedures at different institutions has differed widely. The Task Force also cited the variability of dosimetry calculations for different procedural steps, a variability that has not been quantified. Knowledge about the amount of variability in dosimetry resulting from different procedures and methods at each step in the calculation is essential for focusing standardization and harmonization efforts. Minimizing variability is essential to ensure that dosimetry results can be relied on for clinical investigations and treatment planning and to make a case for reimbursement for dosimetry and related imaging.

The SNMMI Dosimetry Task Force proposed a series of efforts to investigate these sources of variability. These tasks will be performed by participants throughout the nuclear medicine community under the umbrella of the SNMMI $^{177}$Lu Dosimetry Challenge 2021, which will be the first in a series and will provide direction and structure for future challenges. It will also allow the Task Force to assess methods for distribution/collection of data and dissemination of results.

The challenge has the following primary objectives: (1) understand the variability of dose estimates on a standardized dataset of $^{177}$Lu images; (2) identify the largest contributors to variability in dose estimates; (3) identify gaps in knowledge about the sources of variability; and (4) use the collected information to make recommendations for future challenges and for standardization and harmonization of dosimetry methods and output. The goal of the recommendations is to increase concordance of dosimetry results at different sites and institutions. The secondary objective of the challenge is to develop and test a platform and procedure for data sharing that will allow the expansion of this challenge to other therapeutic isotopes (e.g., $^{90}$Y and $^{131}$I).

Academics, industry representatives, clinical practitioners, and anyone with ability and interest in performing radiopharmaceutical therapy dosimetry are invited to participate in the challenge as teams. Teams will be given access to common sets of patient image and metadata and submit dosimetry results. The data will be analyzed to determine sources and magnitude of variability. Teams can register on the website, and all aspects of participation are voluntary. Responses will be kept confidential, and data submitted will be used only for analysis related to the challenge. All submissions and results will be reported only in aggregated form without associating individual results with their contributors. All participating teams, however, will be acknowledged.

The challenge has been divided into 5 tasks. All involve calculating organ and tumor doses but use different input data and start at different points along the dosimetry analysis pipeline. The first 3 are the most time consuming and involve performing dosimetry starting with baseline diagnostic images and postadministration $^{177}$Lu images only. In these tasks, the user must define all regions or volumes of interest and perform all aspects of the dosimetry calculation (except SPECT acquisition and reconstruction for the SPECT/CT datasets). Task 1 uses SPECT/CT images at all timepoints; task 2 uses planar images at all timepoints, and task 3 uses hybrid methodology (i.e., SPECT/CT) at 1 timepoint and planar images at the others. Task 4 uses volumes of interest (VOIs) of the different organs/tumors of interest for this challenge that are to be used in addition to the images provided for task 1. Participants will be asked to compute dosimetry results using the provided VOIs instead of those they defined in the first task. Task 5 adds a precalculated time-integrated activity image, and users will be asked to use that image and the provided VOIs to perform dosimetry calculation.

Leading the Dosimetry Challenge teams are Yuni Dewaraja, PhD (University of Michigan, Ann Arbor), Eric Frey, PhD (Johns Hopkins University, Baltimore, MD), John Sunderland, PhD, MBA (University of Iowa, Iowa City), and Carlos Uribe, MD, MCCPM (BC Cancer, Vancouver, Canada). The challenge uses datasets of 2 subjects who received FDA-approved fixed activity regimens of $^{177}$Lu-DOTATATE for treatment of neuroendocrine tumors (4 cycles of 7.4 GBq/cycle, as in the NETTER-1 trial, administered every 8 weeks). Patient imaging and segmentation were provided by Dr. Dewaraja, and the University of Michigan Deep Blue data repository will manage data for the challenge.

As of mid-March, the challenge has had more than 130 registrants from 25 countries. Detailed information and instructions for registration and participation are available on the website at: https://therapy.snmmi.org/SNMMI-THERAPY/Dosimetry_Challenge.aspx. The website also includes a direct e-mail link for questions about the challenge and participation. Registrants will receive detailed instructions as well as access to the planned sequential downloads. This community-sourced effort is likely to provide not only benefits in practical standardization of $^{177}$Lu dosimetry but to be extensible to future harmonization based on validated user experience.