

Final report to NIBIB on the QIBA 1C study: Inter CT scanner variability in sizing of synthetic nodules by clinicians

The goal of the *Inter CT Scanner study* was to characterize the bias and variation in reader measurements of phantom nodule volumes in CT imagery from multiple scanners.

Methods, images and analysis: The project is a study of reader measurements of volume and longest in-slice diameter on 6 synthetic nodules placed in an anthropomorphic phantom. The phantom was imaged on 6 CT scanners: a Siemens Sensation 64, a Toshiba Aquilion 64, a Philips Brilliance 64, 2 Philips Brilliance 16s, and a GE VCT 64. The imaging protocol had 2 arms, one based on ACRIN 6678; the other determined by device-independent measures of resolution and noise in order to constrain image quality variation. Multiple reconstructions were generated with several kernels. In a single reading session, each of 7 radiologists segmented six nodules, from which the size measurements were automatically derived. The six synthetic nodules had 2 shaped types (spherical and spiculated) and 3 sizes (5-, 10- and 20-mm equivalent radii). The percent relative error in the volume (Vol), $100 * [Vol - \text{nominal Vol}] / Vol$, was tested for effects of scanner, protocol arm, nodule size, nodule shape and reader. Using a t-test, we evaluated the primary hypotheses that the device effects and the protocol effect in the relative error are each no greater than 15%.

Conclusions: The Figure shows that for nearly all scanners, the absolute percent relative error was well below 15% for spherical lesions that are ≥ 10 mm in diameter, regardless of scanner or protocol used; for spiculated lesions, the absolute percent errors were higher, but only a few exceeded 15% (5 out of 154 and most of those were confined to one scanner, regardless of protocol). In the spiculated lesions, 10 out of 154 were greater than 15%.

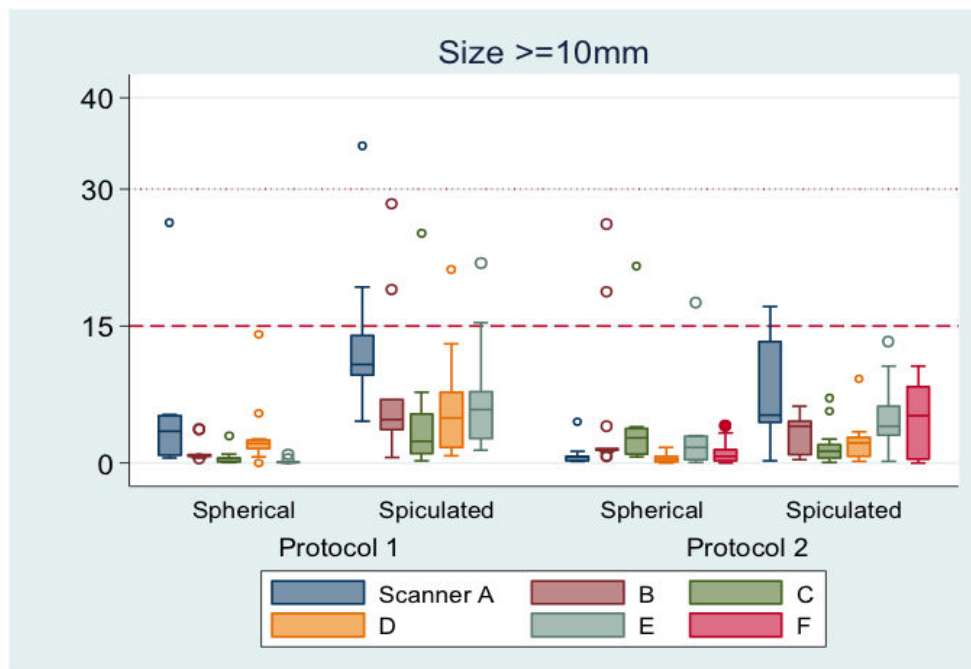


Figure: The absolute percent relative error is displayed by scanner, protocol arm and nodule shape. Protocol arms 1 and 2 were the same for Scanner F. Results from F are displayed under Protocol 2

Study highlights

- For larger lesions (≥ 10 mm in diameter) error and variance are both approximately 15% or less across lesion types, scanners and protocols;
- Study confirms lesion size guidance (≥ 10 mm) in the QIBA CT imaging profile;
- The study produced a large collection of phantom CT image data with repeat scans, all of which is openly available from NBIA;
- Study is the subject of a talk in a Scientific Papers Session at RSNA 2012.

All of the deliverables of the NIBIB proposal have been completed. All related future publications will be made available on the QIBA website.

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