Interobserver Variability in Clinical Target Volume Delineation for Online Adaptive Accelerated Partial Breast Irradiation

Udbhav S. Ram,[1,2] Jingwei Duan,[1,3] Rex A. Cardan[1], Anna Robbins[1], M. Christopher Dobelbower[1], Corey Speers[1], Courtney B. Stanley[1], Dennis N. Stanley[1], Drexell H. Boggs[1], Jessie Lacy[1], Kimberly Keene[1], Madelyn Wine[1], Michael Soike[1], Natalie N. Viscariello[1], Ndipnu Lima[1], Melissa Tyler[1], Carlos E. Cardenas[1]‡, and Joel A. Pogue[1]*‡

1. Department of Radiation Oncology, The University of Alabama at Birmingham, Birmingham, Alabama, USA
2. Department of Physics and Astronomy, McMaster University, Hamilton, Ontario, Canada
3. Department of Radiation Physics, University of Texas MD Anderson Cancer Centre

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AIMS

Accelerated partial breast irradiation (APBI) with online adaptive radiotherapy (OART) enables daily localization of the lumpectomy cavity in early-stage breast cancer. Interobserver variability (IOV) in delineation may affect target coverage and workflow efficiency. This study quantified IOV in CBCT-guided adaptive APBI across professional groups and evaluated target-editing efficiency.

METHODS

Fourteen patients previously treated with CBCT-guided OART APBI (30 Gy in 5 fractions) were retrospectively analyzed. Fourteen observers; radiation oncologists (n = 5), medical physicists (n = 3), medical dosimetrists (n = 3), and radiation therapists (n = 3), independently edited deformably propagated lumpectomy cavity contours (GTVsb) on CBCT images from fractions 1 and 5 while self-timing.

Physician-consensus GTVsb contours were generated using 3-of-5 per-voxel majority voting and expanded by 1 cm to create reference CTVsb contours. Observer CTVsb contours and corresponding PTVsb contours generated with 1–5 mm isotropic margins were compared with consensus using intersection ratios, volume ratios, Dice similarity coefficients, and 95th-percentile Hausdorff distances. Unedited autocontours served as a baseline.

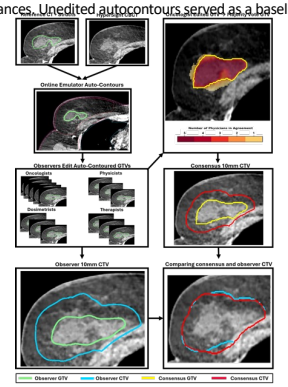

Figure 1: Sample analysis workflow for one patient across all reviewers.

RESULTS

- Minimum IOV-derived PTV margins required to achieve ≥90% physician-consensus CTVsb coverage in 90% of cases were;
  - **0 mm for unedited autocontours**
  - **1mm for dosimetrist-edited contours and therapist-edited contours**
  - **and 2 mm for physician-edited and physicist-edited contours.**
- At group-specific margins, median consensus CTVsb coverage exceeded 98% for every group.
- Larger margins for physicians and physicists were offset by smaller CTVsb contours, resulting in similar overall PTVsb volumes across professional groups.
- **Contouring times differed significantly** between physicians and non-physicians ($p < 0.0001$), with median per-session times of 2.2 and 5.4 minutes, respectively.

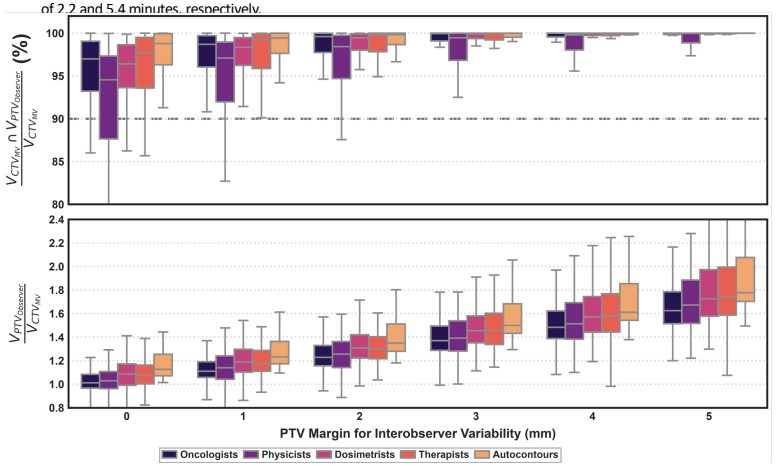

Figure 2: Boxplots showing the effects of additional margins on IOV for **true positive rate (top)** and **volume ratio (bottom)** compared with physician majority-vote CTVsb contours.

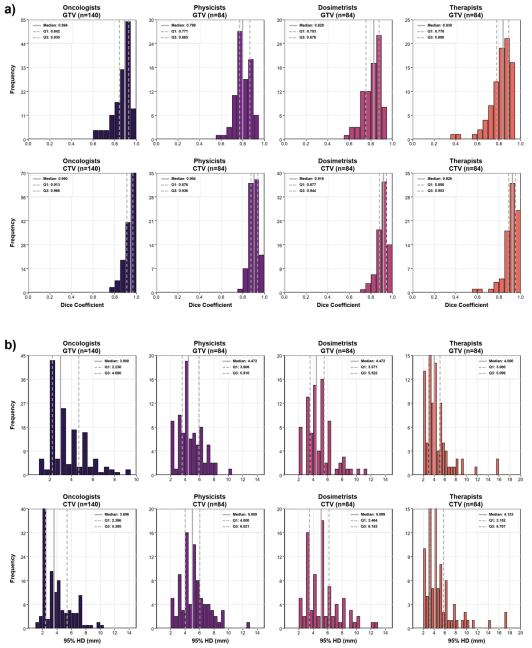

Figure 3: DSC (a) and **HD95 (b)** comparisons between physician-consensus contours and observer-group contours for GTVsb and CTVsb

CONCLUSIONS

Measurable IOV occurred across all professional groups. IOV-derived PTV margins for 90% consensus CTVsb coverage in 90% of cases ranged from 1 mm for unedited autocontours, therapists, and dosimetrists to 2 mm for physicians and physicists. Similar PTV volumes across groups support incorporating IOV into OART margin design, with therapist- or dosimetrist-led editing requiring structured training, credentialing, and oversight.

CONTACT INFORMATION

*Corresponding author: jpogue@uabmc.edu
‡ Shared senior authorship: ccardenas@uabmc.edu
Udbhavram41@gmail.com @UdbhavRam

Abstract Info