Trust but Verify: Evaluating Human Modifications to Auto-Generated Rapidplan Prostate SABR Radiotherapy Plans

Conor Smith[1], Dominique Fortin[2], Isabelle Gagne[2]

[1]Department of Physics and Astronomy, University of Victoria. [2]Department of Medical Physics, BC Cancer Victoria.

PURPOSE

Knowledge-based planning tools like RapidPlan (RP) estimate dose-volume histograms (DVHs) for organs-at-risk (OARs) based on anatomical features and historical data. These DVH estimates are then used to guide treatment planning prior to optimization. However, planners may modify the optimization parameters generated by RP.

This study aims to quantify the frequency and types of modifications to RP objectives and evaluates whether these manual interventions improve protocol compliance.

METHODS

- Retrospective cohort of 253 prostate SABR plans
- Comparison of RP-generated objectives vs. final clinical plan objectives using automated data extraction and matching algorithm.
- Modification of objectives categorized in terms of: priority, dose, volume, combinations, added/removed objectives.
- For patients flagged as 'modified', an unaltered fully automated plan was generated for comparison.
- Protocol compliance was assessed for clinical vs. fully automated plans.
- Differences in median protocol metrics assessed with Wilcoxon signed-rank test.

OPTIMIZATION PARAMETERS

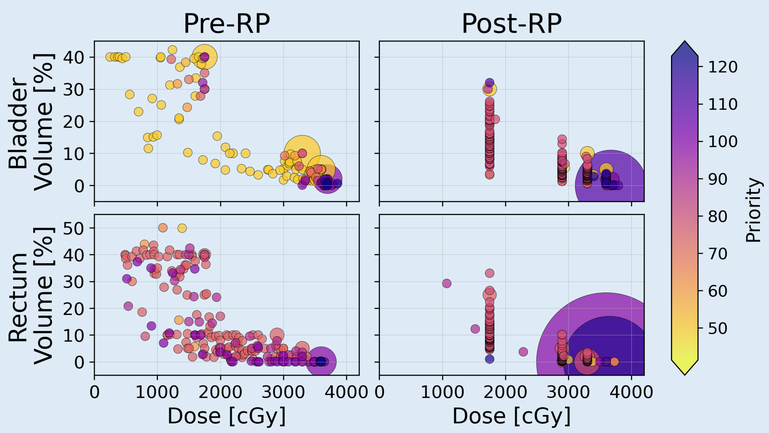

Figure 1. Optimization Parameters Before and After RP Implementation

- Bubble size ∝ frequency of unique objective triplets.
- Manual planning (Pre-RP) shows scattered, subjective parameter choices.
- RP implementation produces tight clustering, reflecting standardized, model-driven objectives across plans.

PLANNER-OPTIMIZER INTERACTIONS

At least one optimization parameter modified in 61% of plans, 39% were fully automated (no edits).

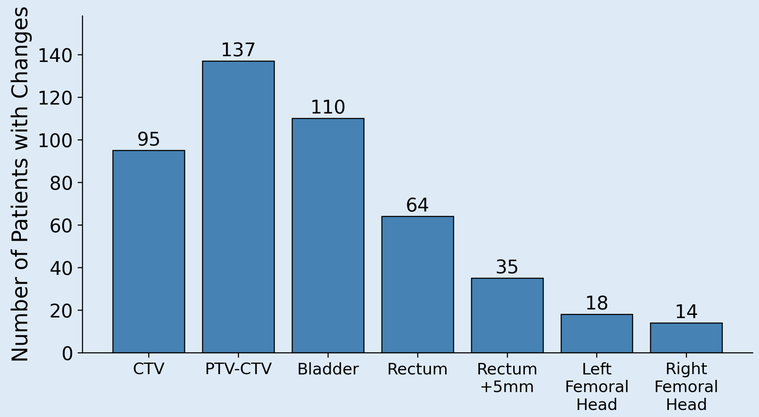

Figure 2. Patients with Optimization Changes by Structure.

- Number of patients with at least one modified objective for each anatomical structure.
- Modifications were most frequently applied to the CTV, PTV, rectum, and bladder.

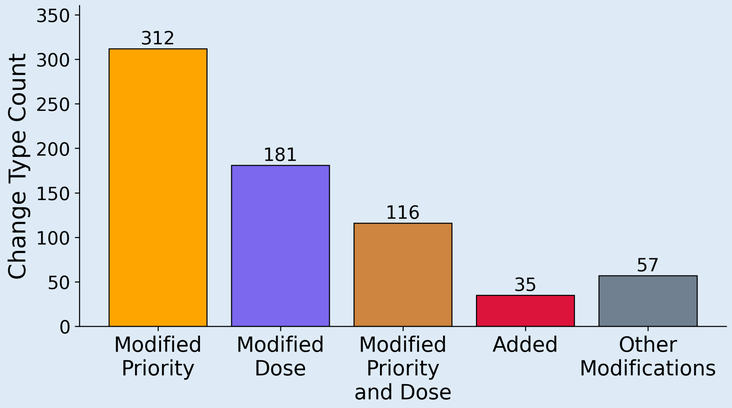

Figure 3. Distribution of Objective Change Types.

- Changes to the priority were the most common intervention, followed by dose modifications and combined priority-and-dose changes.
- "Added" represents objectives inserted by planners beyond RP auto-generated objectives.
- "Other Modifications" include: modifications to volume, combined dose-volume, and modifications to all three parameters.

University of Victoria

BC CANCER

CONTACT

conorsmith@uvic.ca

CLINICAL VS. AUTOMATED PLANS

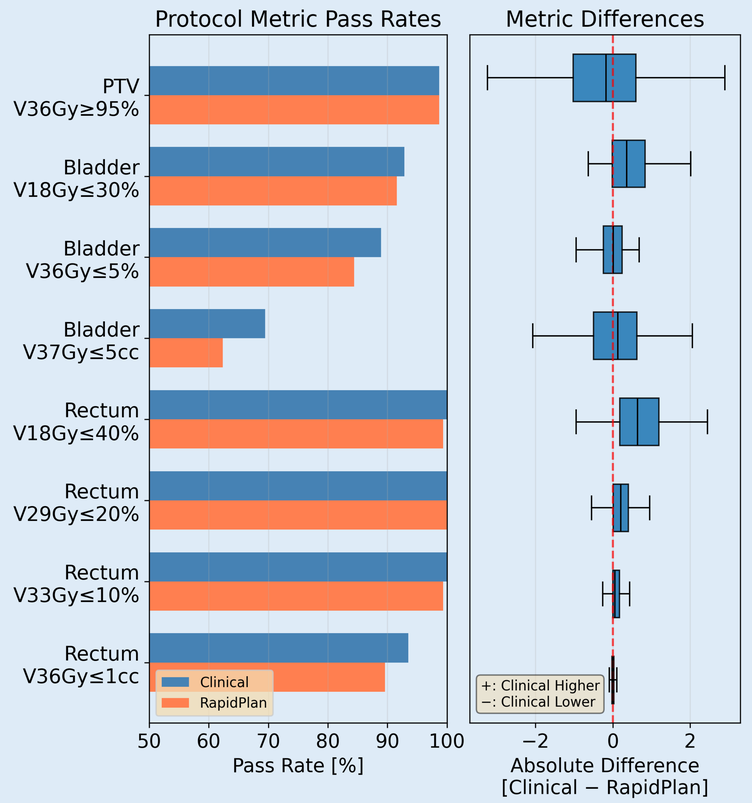

Figure 4. Clinical vs Fully Automated Plans.

- **Left:** Pass rates for protocol preferred metrics.
- Among the 154 clinical plans that had modified optimization parameters, 53% met all primary protocol goals, compared to 45% for unmodified automated plans.
- **Right:** Box plot showing differences between clinical vs automated plans for various rectum and bladder metrics.
- Not statistically significant ($p > 0.05$) changes to Bladder V37/V36 Gy, Rectum V36 Gy metrics
- Small but statistically ($p < 0.01$) significant increases in clinical plans of:
  - Rectum V18 Gy, V29 Gy & V33 Gy metrics
  - Bladder V18 Gy & V29 Gy metrics

CONCLUSIONS

- Automated planning met preferred goals in 67% of cases.
- When human modifications occur, dosimetric differences are small but increase protocol compliance by 8%.
- Supports a tiered workflow:
  - Favorable anatomy → automated planning
  - Unfavorable anatomy → planner intervention needed
- Future models could incorporate common modification patterns to further reduce the need for manual intervention.