Efficiency, Quality and Clinical Perception of Single-Click Automated Prostate Planning

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Background

- Knowledge-based planning (KBP) can enhance homogeneity and efficiency in RT treatment plans.
  - Needed manual tweaks may undermine dosimetrist confidence in KBP models.
- We present our end-to-end, **single-click** KBP-based planning tool and evaluate its performance in prostate RT planning.

Methods

The entire planning process was automated using in-house tools.

- Eclipse Scripting API automates **ALL** manual planning steps:
  1. Creates plan optimization structures
  2. Automatically sets predefined field geometry
  3. Applies KBP model, then optimizes/calculates plan
  4. Generates plan-specific tuning structures for optimization.
  5. A second auto-optimization generates multiple plan versions.

Likert Scale Definition	
1	not useful as a starting plan
2	major edits needed
3	minor edits needed
4	plan would pass peer-review
5	use as is

Table 1. Definition of plan evaluation scale.

We retrospectively replanned 15 prostate cases using our single-click solution. Each plan was visually inspected and scored on a 1–5 Likert scale (Table 1) as an indicator of clinical acceptability. Prescriptions used were:

- **Prostate:** 70 Gy in 28 fractions
- **Prostate + Nodes:** 70/50.4 Gy (PTV_High/Low) in 28 fractions (SIB)
- **Prostate Bed + Nodes:** 64.8/45 Gy (PTV_High/Low) in 36 fractions: 25 + 11 boost (2 plans).

Results

All automatically generated plans:

- ✅ were created in less than 1 hour
- ✅ met clinical goals (target and OAR)
- ✅ review by 1 physician and 1 dosimetrist

When analyzing the same plans, the ratings for each professional were as follows:

- Physician: 75% of plans were rated 4 or 5
- Dosimetrist: 40% of plans were rated 4 or 5

The most common scores assigned by both participants were 5 and 3, average scores are shown in Figure 1. Figure 2 shows cases of reviewer disagreement (A and B) and agreement (C).

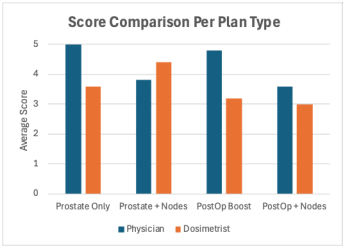

Figure 1. Comparison of average scores by physician and dosimetrist across different plan types

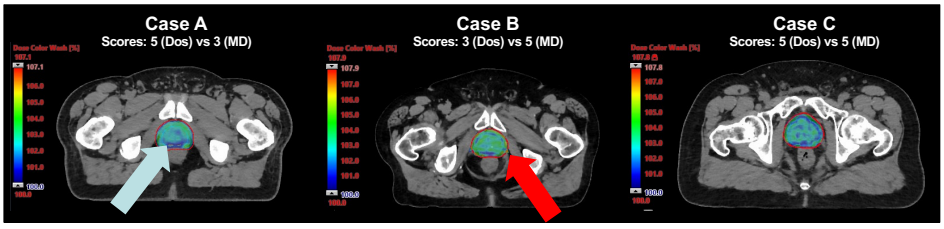

Figure 2. Comparison of plan score differences/similarities between physician (MD) and dosimetrist (Dos). PTV High (red contour) coverage is shown with dose wash. Case A shows MD (blue arrow) dissatisfied with target coverage, while Case B shows dosimetrist (red arrow) dissatisfied with dose spill. Case C was deemed high quality (score of 5) by both. All met clinical coverage and OAR goals.

Conclusions & Clinical Implications

- We developed a fully automated, iterative solution for prostate RT that provides patient-specific tuning structures to further refine KBP-based plans, all encapsulated into a single-click.
- Our approach produced plans that meet all clinical goals, but that may be perceived differently between the dosimetrist and the physician.
- All qualitative feedback has been incorporated into our planning pipelines, and we have clinically-released our automated planning solution.

Future Directions

- **Prospective evaluation of how dosimetrists** interact with and use automated tools in routine clinical practice:
  - Monitor and log manual adjustments dosimetrists make to automated plans.
  - Compare cost functions between automated and manually adjusted plans.
- **Prospective evaluation of physician** qualitative assessment:
  - If OAR and target metrics are met, log physician-requested plan alterations.
  - Document the clinical reasoning for desired changes.
- Gathered data from dosimetrists and physicians will inform the ongoing refinement of the KBP models and associated automated pipelines.

Contact Information

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