

Evaluation of a Novel, AI-Driven, Automated Treatment Planning System

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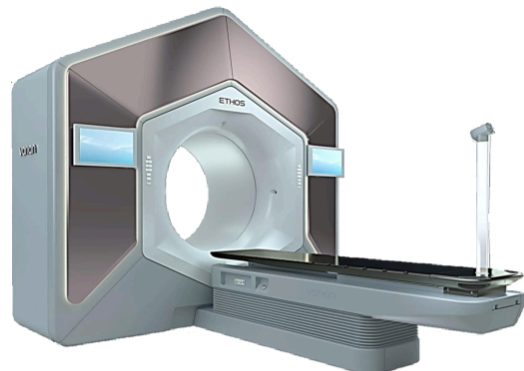
RETHINKING MEDICAL PHYSICS

PURPOSE

To evaluate the quality of auto-generated plans from the Varian Ethos Platform against our clinically validated RapidPlan Models.

MOTIVATION

- The recently-released Varian Ethos platform generates treatment plans using an Intelligent Optimization Engine (IOE) without traditional user-navigated inverse optimization.
- All optimization structures (e.g. rings, cropped organs) are auto-generated by the IOE without user oversight.
- To ensure the IOE can generate acceptable plans, it is critical to quantitatively compare Ethos-generated plans to previous planning practices.



METHODS

Patients: 8 Gynecological, 5 H&N, and 10 prostate cases were replanned using Ethos.

Ethos Plans: Generated plans used 12-field IMRT and only clinical standards as input goals.

KBP Plans: Each case was re-planned using our clinically validated knowledge-based planning (KBP) model for the matching treatment site.

Analysis: DVH metrics were compared using signed-rank test with Bonferroni correction.

RESULTS

- GYN Ethos plans had lower PTV doses, greater sparing of the bladder and rectum in the high dose region, and equivalent bowel and bone marrow sparing.
- H&N Ethos plans showed small increases in PTV dose equivalent OAR dose sparing.
- Prostate PTV and OAR metrics improved or stayed consistent with Ethos planning.

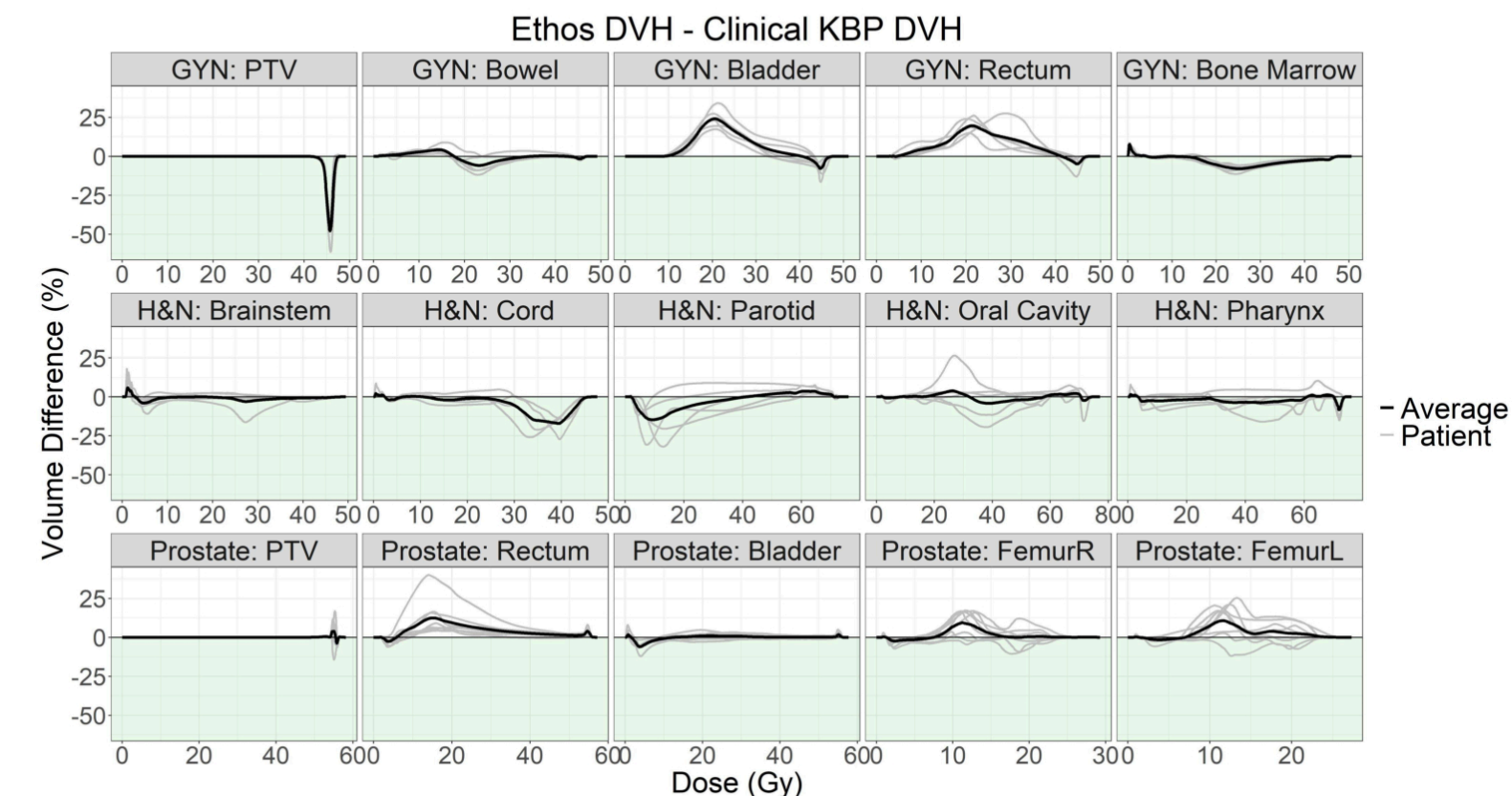


Figure 1: The Ethos-produced DVH was subtracted from the Clinical plan's DVH for each patient (light grey lines) and an average of the differences for each treatment site (GYN n=8, H&N n=5, Prostate n=10) was calculated (bolded black line). Values in light green indicate Ethos had lower dose than the clinical plan generated with KBP.

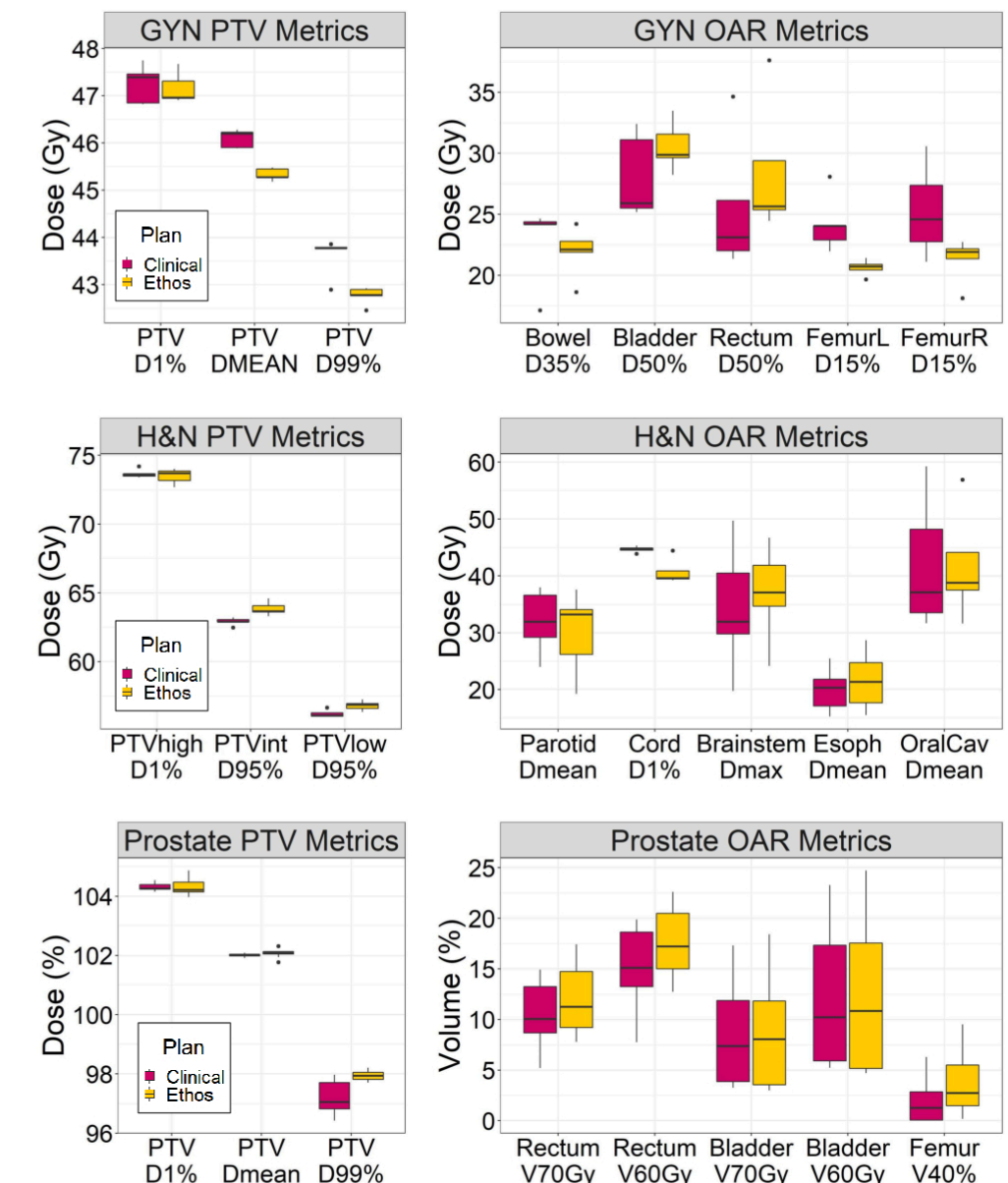


Figure 2: Boxplot of the DVH metrics from the Ethos (yellow) versus Clinical (pink) plans calculated with our knowledge-based models. No metrics were significantly different (signed rank test with Bonferroni correction) indicating that Ethos produces high-quality plans while substantially reducing the manual steps needed for treatment planning.

CONCLUSIONS & IMPACT

Our results show that the fully-automated Ethos IOE generates clinically equivalent plans to existing knowledge-based models that have been in routine clinical use and validated across hundreds of patients at our institution.

This study is the first to examine whether a novel treatment planning system with an AI driven optimization engine can automatically produce high-quality plans when given only clinical goals.

ACKNOWLEDGEMENTS

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