

# Integrating Knowledge-Based Models for An Enhanced Iterative Automated Treatment Planning Process

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## INTRODUCTION

- Knowledge-based planning (KBP) is a useful tool in the treatment planning process.
- However, without intervention, KBP may have difficulty returning clinically acceptable plans.

## PURPOSE & OBJECTIVES

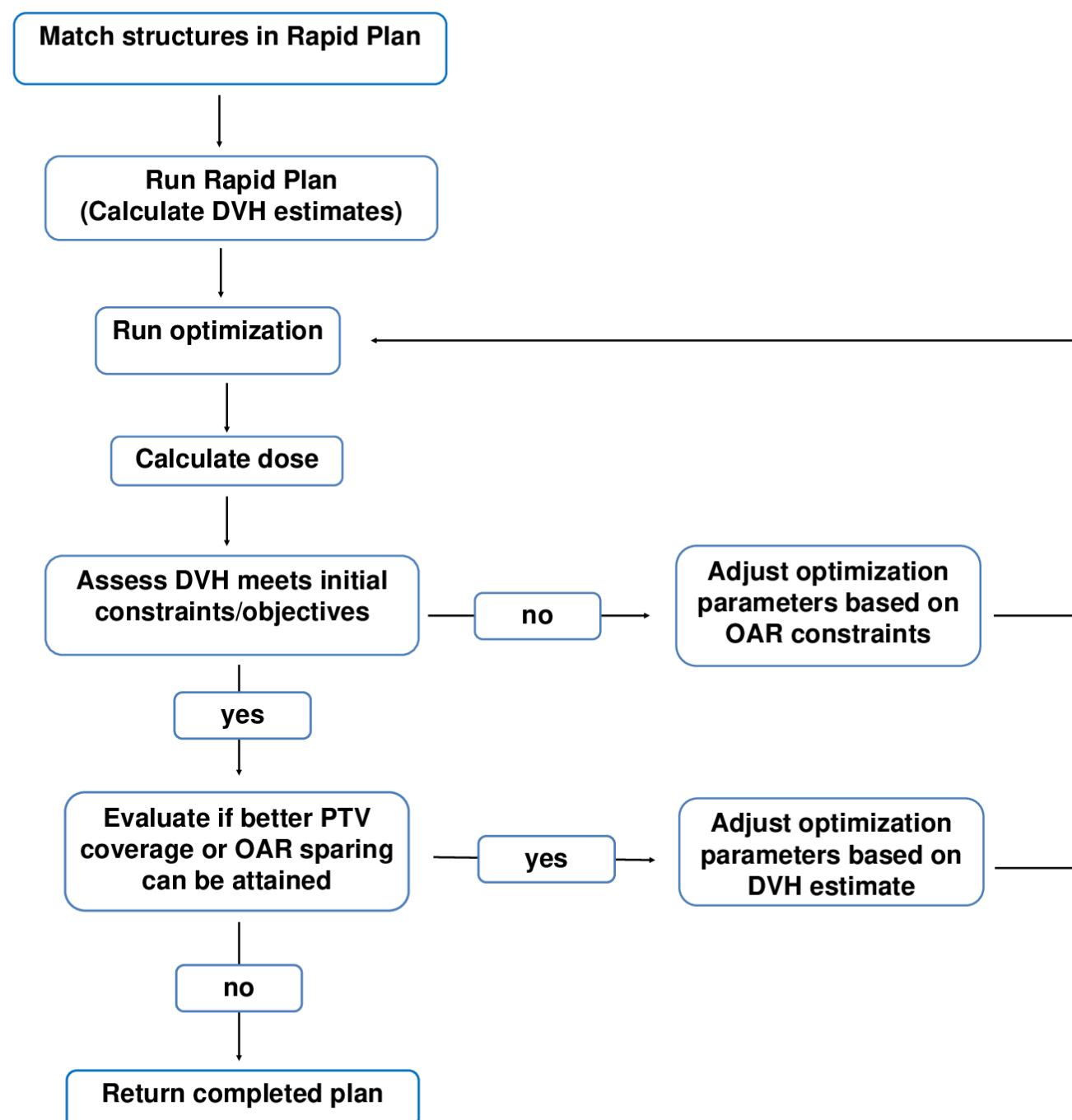
- Apply an iterative optimization approach to KBP to design an automated treatment planning process yielding high quality clinical treatment plans with time savings.

## METHODS & DISCUSSION

- Varian's Eclipse Scripting Application Programming Interface (ESAPI) and Rapid Plan version 15.6.
- The iterative automated treatment planning process used for a segmented low-risk prostate with SBRT fractionation has two main evaluation stages: optimization constraint modification and DVH comparison.
- Once initial constraints are met, the program compares the estimated DVH to the calculated DVH.
- The area under the curve is divided into segments to see if PTV coverage or OAR sparing can be improved, while considering tradeoffs.
- In the final stage, the plan re-calculates dose and re-assess the DVH until an acceptable dose distribution is attained.

## RESULTS

### ITERATIVE KBP WORKFLOW



### DVH ESTIMATE

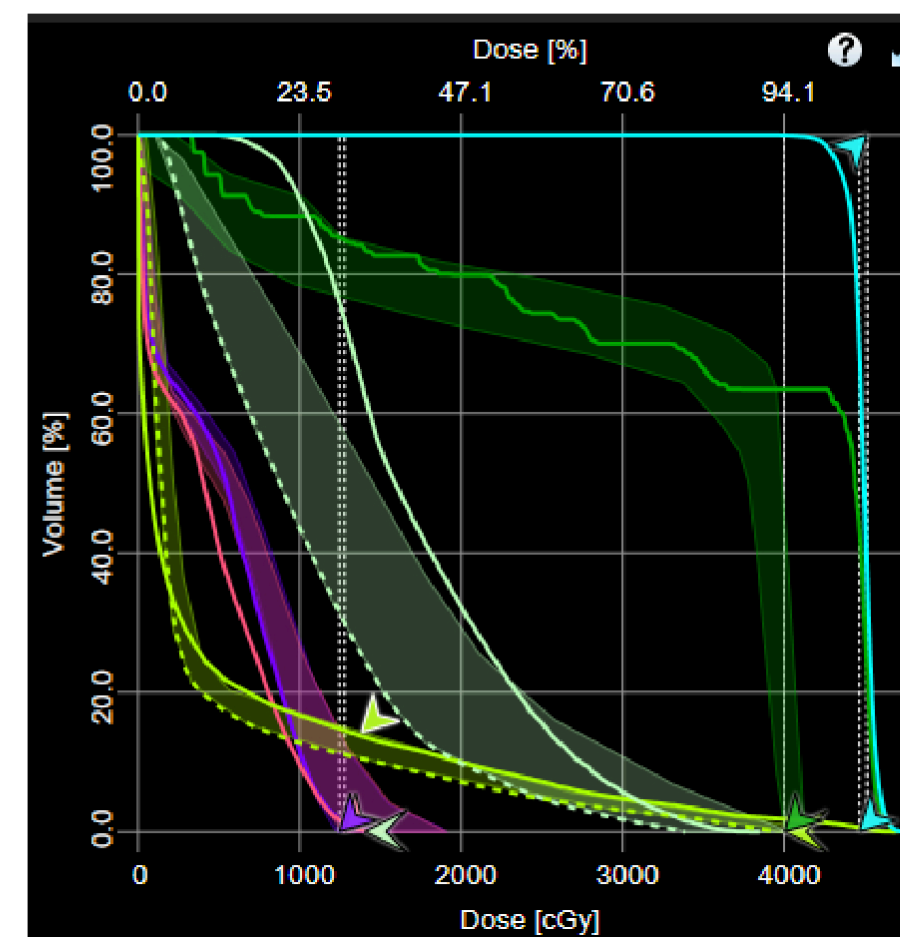


Figure 1 (left): Model of proposed iterative KBP end to end process, featuring the two main assessment stages of constraint modification and DVH comparison.

Figure 2 (above): Estimated DVH for prostate SBRT. The solid and dashed lines represent the current and minimum values, respectively. The shaded portions reflect the estimated range. The PTV is in cyan, while the following OAR's are included: bladder (yellow), left femoral head (pink), right femoral head (purple), rectum (lime) and urethra (green).

## SUMMARY & CONCLUSIONS

- The proposed automated planning architecture can be integrated into pre-existing treatment planning workflow and protocols.
- Following constraint approval, the main logic mimicking the planning process is the DVH assessment of achieving better PTV coverage or OAR sparing based on constraints and predicted DVH.
- Completed auto-generated plans can be returned as deliverable plans, or at minimum jump start the planning process for physics staff.
- Implementing such an auto-planning program can provide efficiency, alleviating heavy clinical workloads, while still ensuring the standard of care for personalized radiation therapy plans.
- Future work includes: further auto-generated plan evaluation and application to additional treatment sites.

## REFERENCES

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