



JOHNS HOPKINS

MEDICINE

RADIATION ONCOLOGY & MOLECULAR RADIATION SCIENCES

# Multi-institutional plan quality checking tools built on Oncospace: A shared radiation oncology database system

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## Purpose/Objectives

RT patients are assumed to be less at risk for treatment related toxicity when Organs At Risk (OARs) are subjected to lower doses of radiation. We aim to use a multi-institutional data store of past treatment experience to develop tools to:

- Check the quality, while controlling for individual patient anatomy, of a single treatment plan against previous plans
  - Compare past treatment history between centers to discern institutional patterns and proclivities in OAR sparing
- Treatment history is represented as data combined from members of the Oncospace Consortium.

## Materials/Methods

# Oncospace

The plan quality tools operate on data in the Oncospace Consortium, consisting of instances of the Oncospace system local to each participating center. Each instance has the same data schema, which provides seamless querying across institutions and ease of sharing and combining data.

Oncospace has a database designed for the storage and retrieval of data artifacts of the entire RT experience, including:

- Dose Volume Histograms (DVHs)
- Overlap Volume Histograms (OVHs): A distance relationship between RT targets and critical structure (Figure 1)

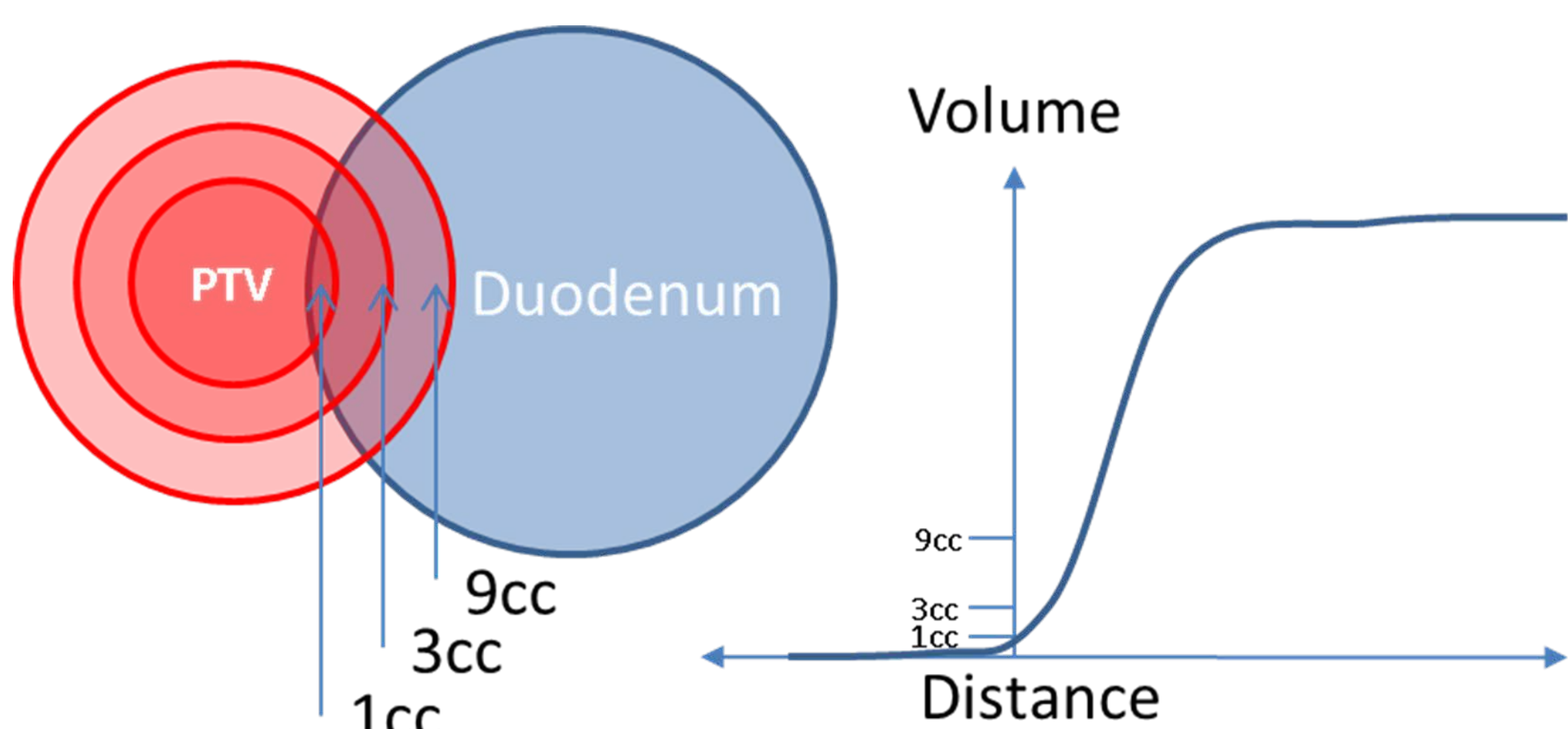


Figure 1: OVH – distance measure from OAR to target

## Materials/Methods (cont'd)

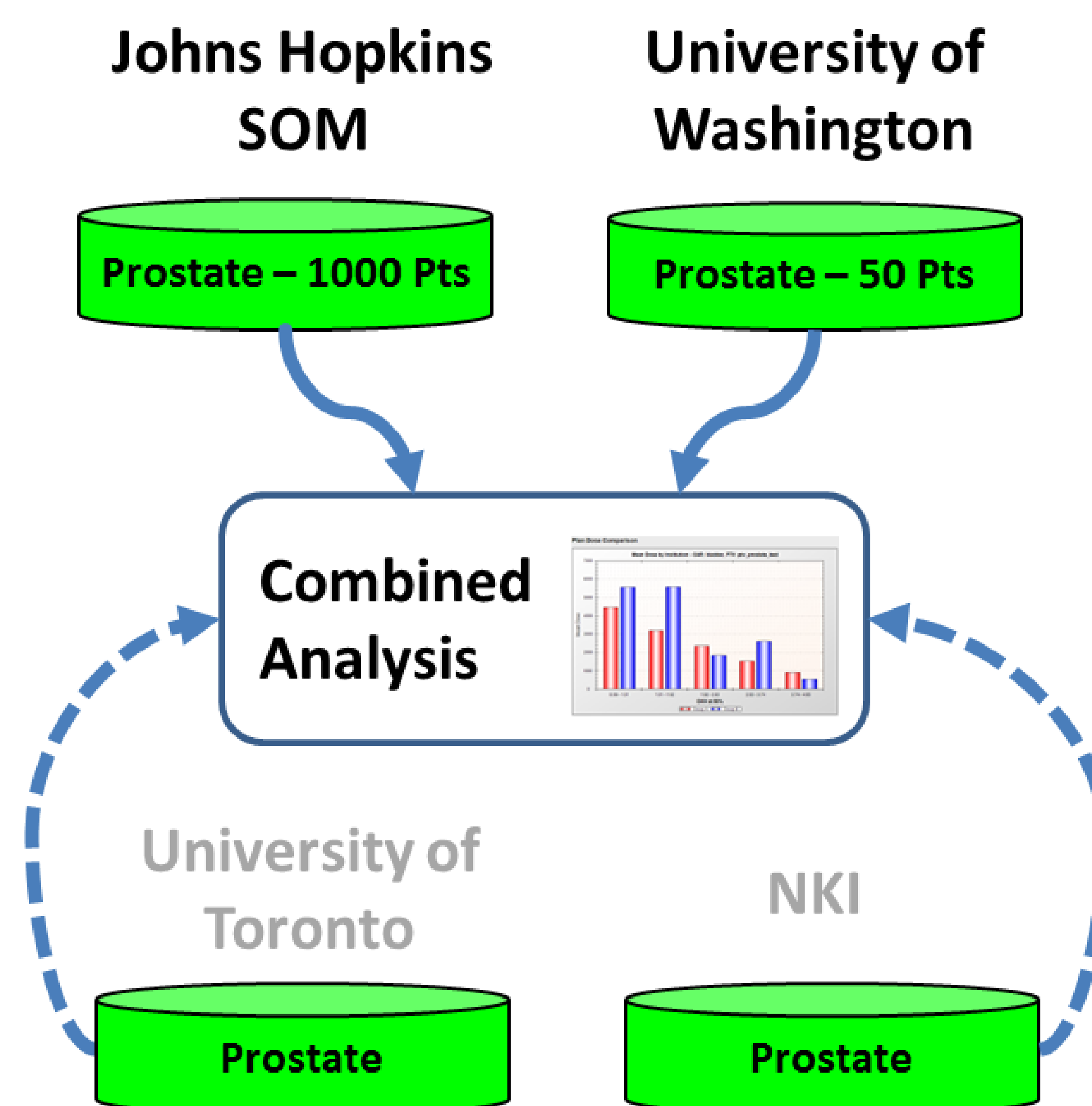


Figure 2: Initial configuration of Consortium Participation in Prostate Plan Quality Study. UT and NKI are collecting data into Oncospace and will participate in future plan quality studies.

Plan quality tools were developed jointly between UW and JHSOM.

- To evaluate a single plan – select all patients anatomically harder to plan (lower OVHs) than the candidate, and compare the planned dose level to previously achieved doses. The candidate plan should be among the lowest DVHs.
- To evaluate an institution's plans – group patients with like anatomy (similar OVH) and calculate mean dose for those patients. Compare that mean dose to similar patients at other institutions.

## Results – Single Plan Quality Check

### Lowest Achieved Dose to Left Parotid (Figure 3)

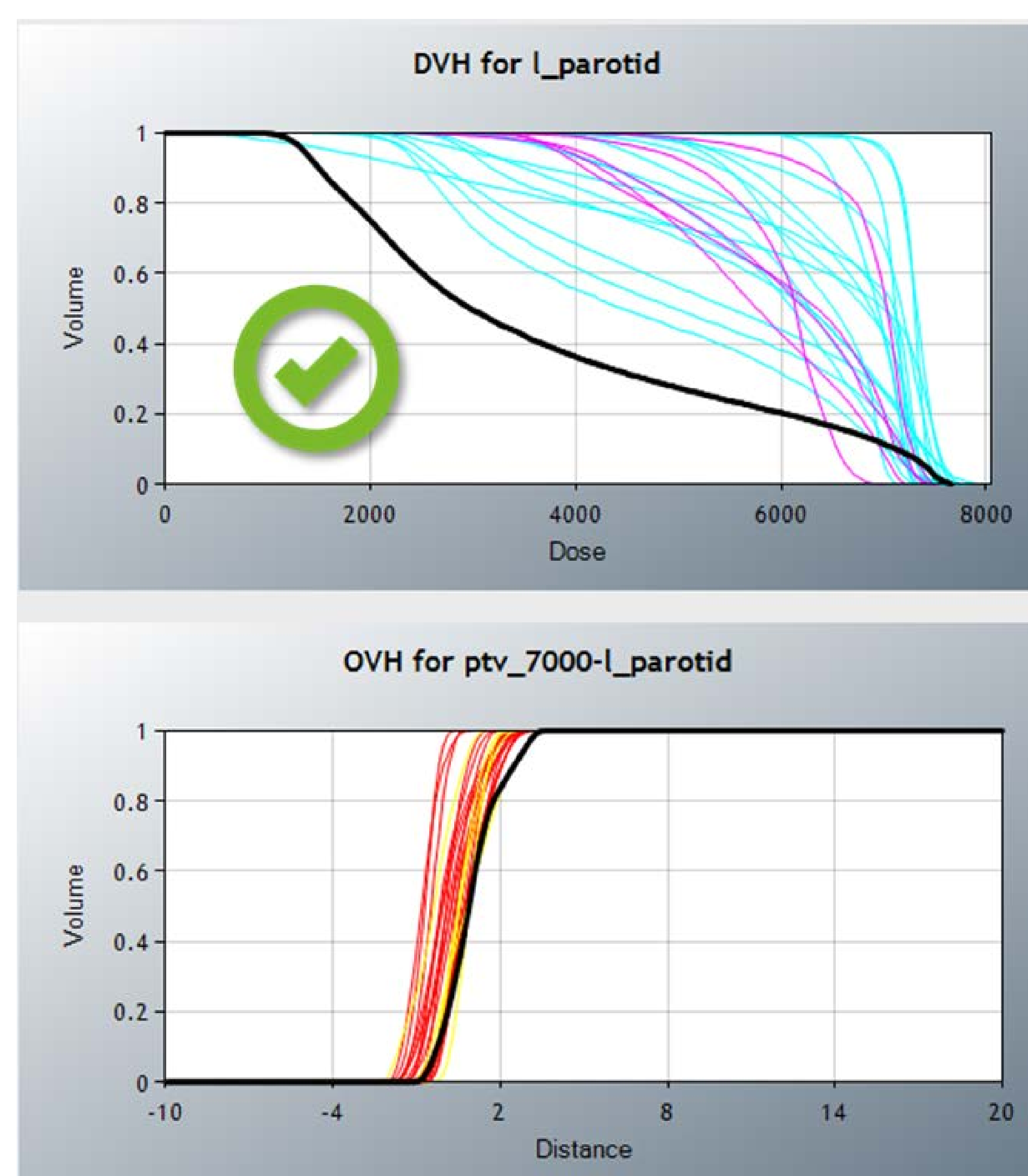


Figure 3: Curves color coded by institution. Bottom - the patient OVH (black) is plotted with all patient's whose left parotid is harder to plan (lower OVH). Top – candidate dose level is lower than all doses to harder to plan left parotids in our combined treatment history.

### Is a Lower Dose Achievable? (Figure 4)

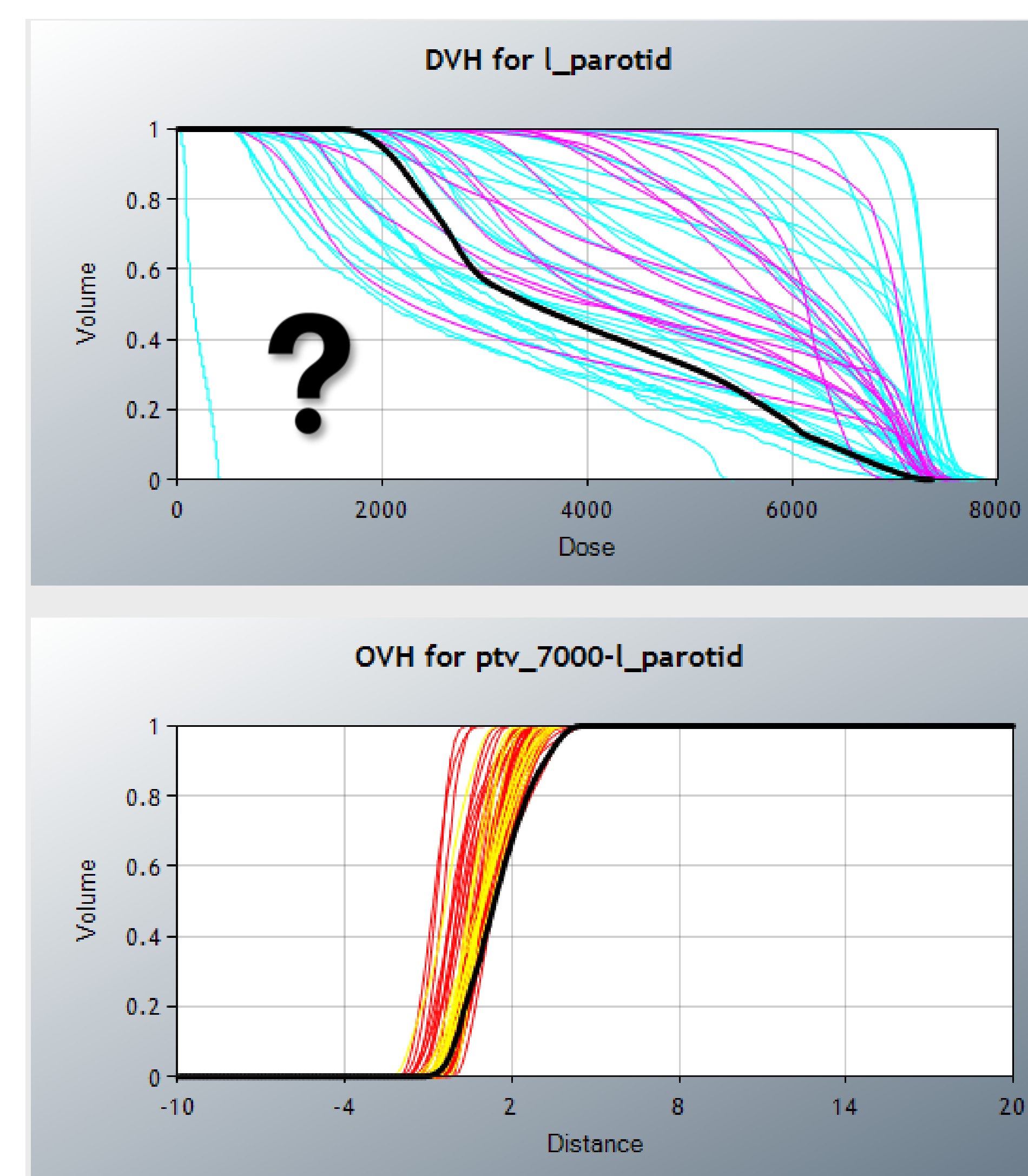


Figure 4: Patient (seen at magenta institution) plotted with harder-to-plan patient OVHs below, and DVHs above. Several harder-to-plan patients received plans with significantly lower dose levels, especially at the cyan institution. Might indicate a close look at dose objectives is warranted.

## Results (Cont'd)

### Multi-institutional plan comparison (Figure 5)

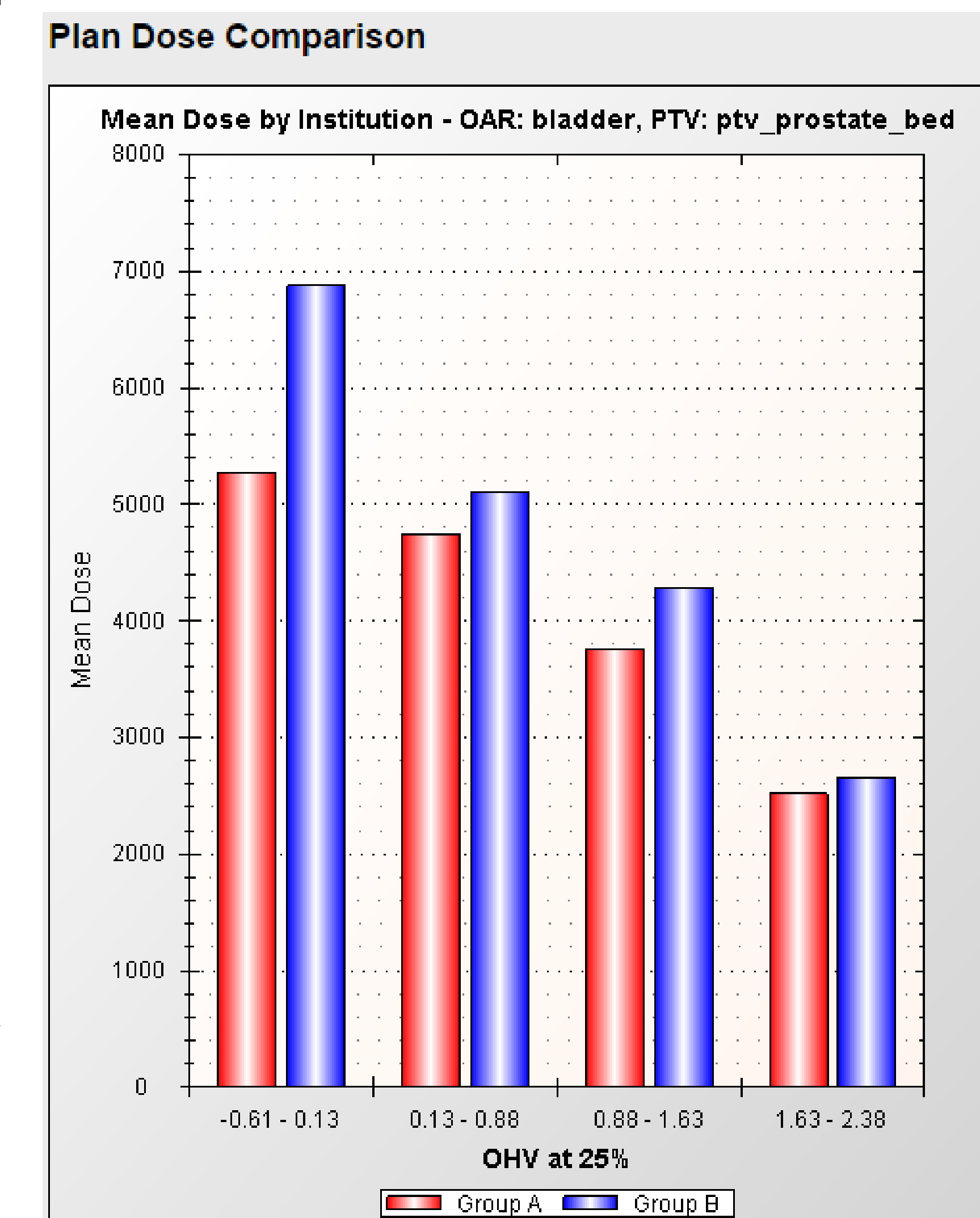


Figure 5: To compare dose levels by institution, group planned treatments by OVH – a distance measure from the OAR (Bladder) to the target structure (PTV Prostate Bed). Compare the mean doses to the OAR for each group. Institution A exposes the OAR to less collateral dose for each group. The tool can search any OAR/PTV combination at any distance/dose percentage.

## Conclusions

Oncospace provides a queryable, relational data-store for comparing anatomy to dose to study plan quality questions. The Oncospace Consortium is based on a common schema to combine data across institutions. The tools developed can be used to gain insight about the quality of a candidate treatment plan, or about inter-institutional plan characteristics.

## Acknowledgements

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