

# Protocol-Agnostic Machine Learning for Thoracic Radiotherapy Planning: Clinical Results and Workflow Benefits

Jaykumar Patel<sup>1</sup> and Todd McNutt<sup>1</sup>

<sup>1</sup>Radiation Oncology and Molecular Radiation Sciences, Johns Hopkins University School of Medicine, Baltimore, MD, USA

## 1. INTRODUCTION

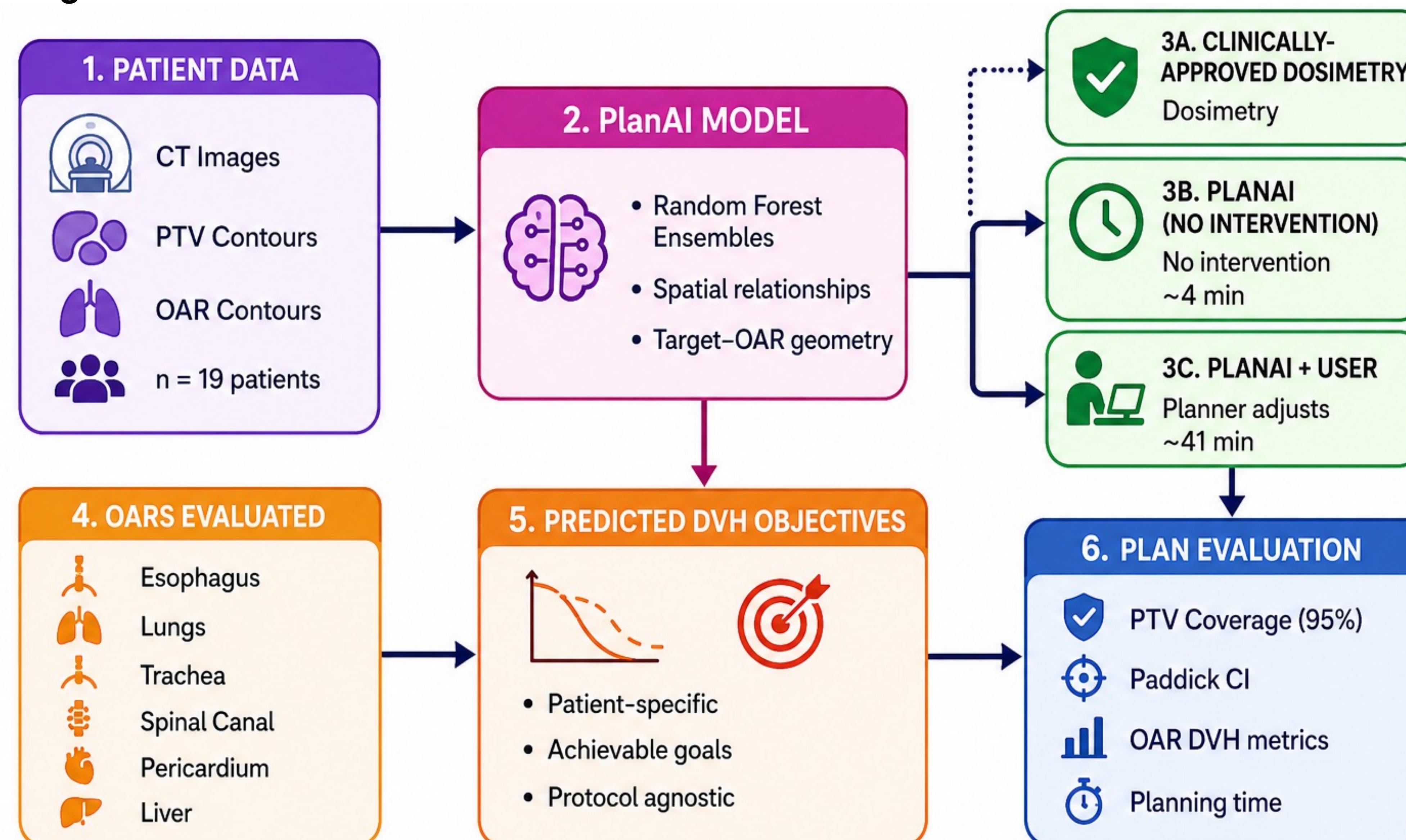
- Treatment planning for thoracic radiotherapy requires balancing target coverage with OAR sparing
- Manual optimization is time-consuming and planner-dependent
- Machine learning offers potential for automated, patient-specific planning

## 2. OBJECTIVE

- To evaluate PlanAI, a protocol-agnostic machine learning model that predicts achievable DVH objectives for thoracic radiotherapy planning.

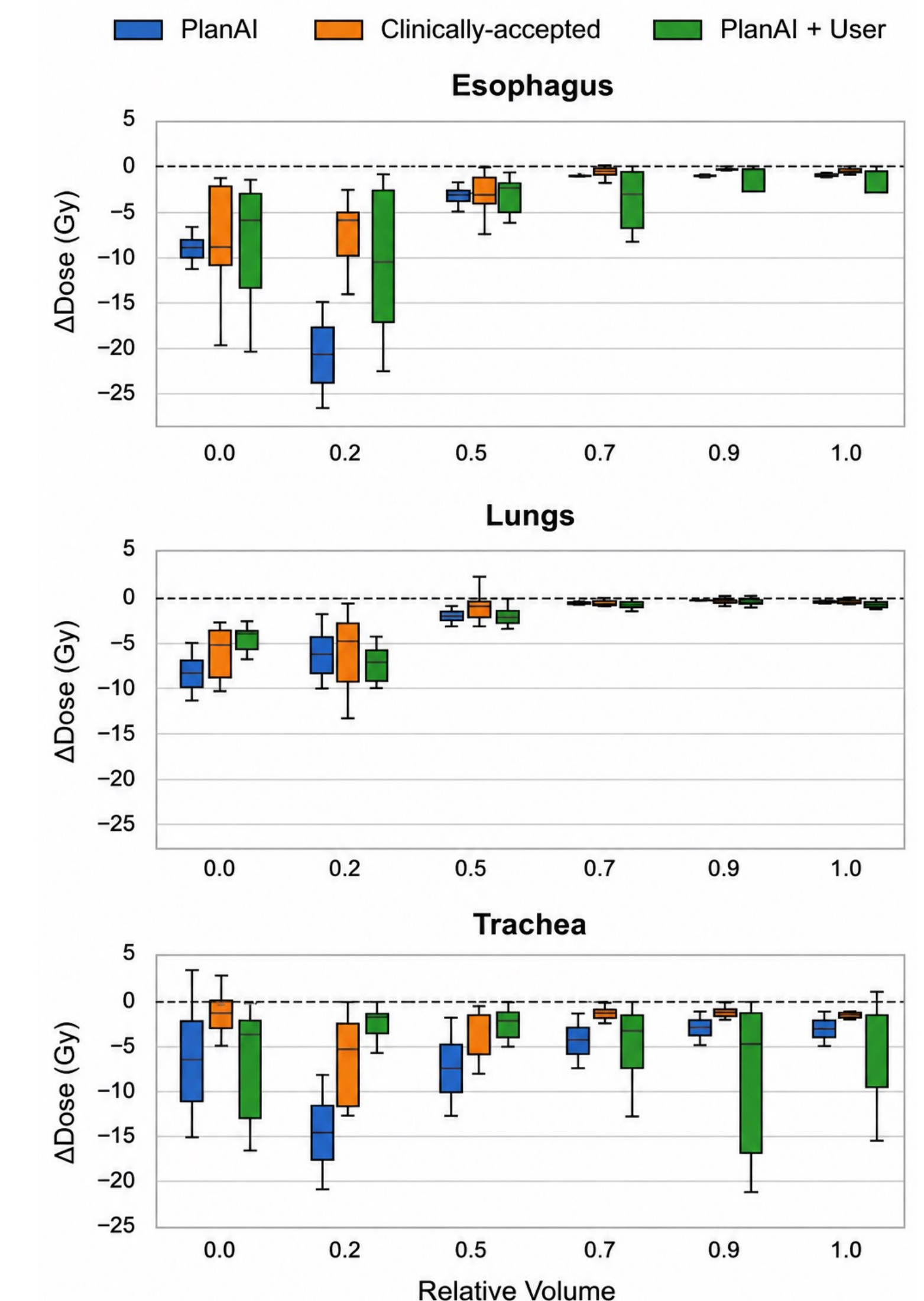
## 3. METHODS AND WORKFLOW

Figure 1: Methods and Workflow



## 4. RESULTS: DVHs

Figure 2: DVHs: Actual vs Expected Dose differences between actual and expected DVH



## 5. RESULTS

Figure 3: OAR DVHs

Cohort OAR mean DVHs ( $\pm 1$  SD). PlanAI reduces low-dose spillage (esophagus, pericardium, stomach, trachea) while maintaining coverage and DVHs that closely match clinical DVHs.

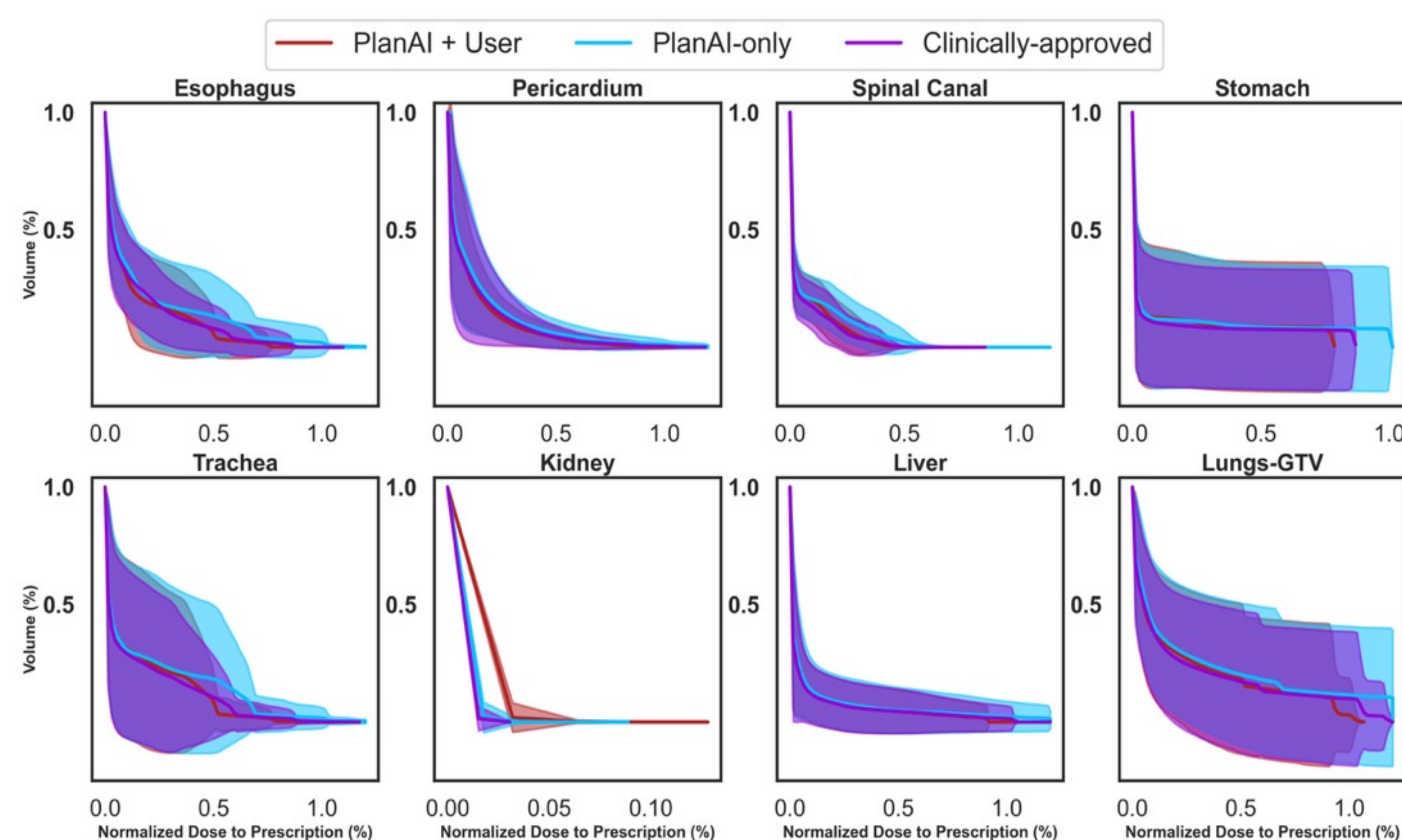
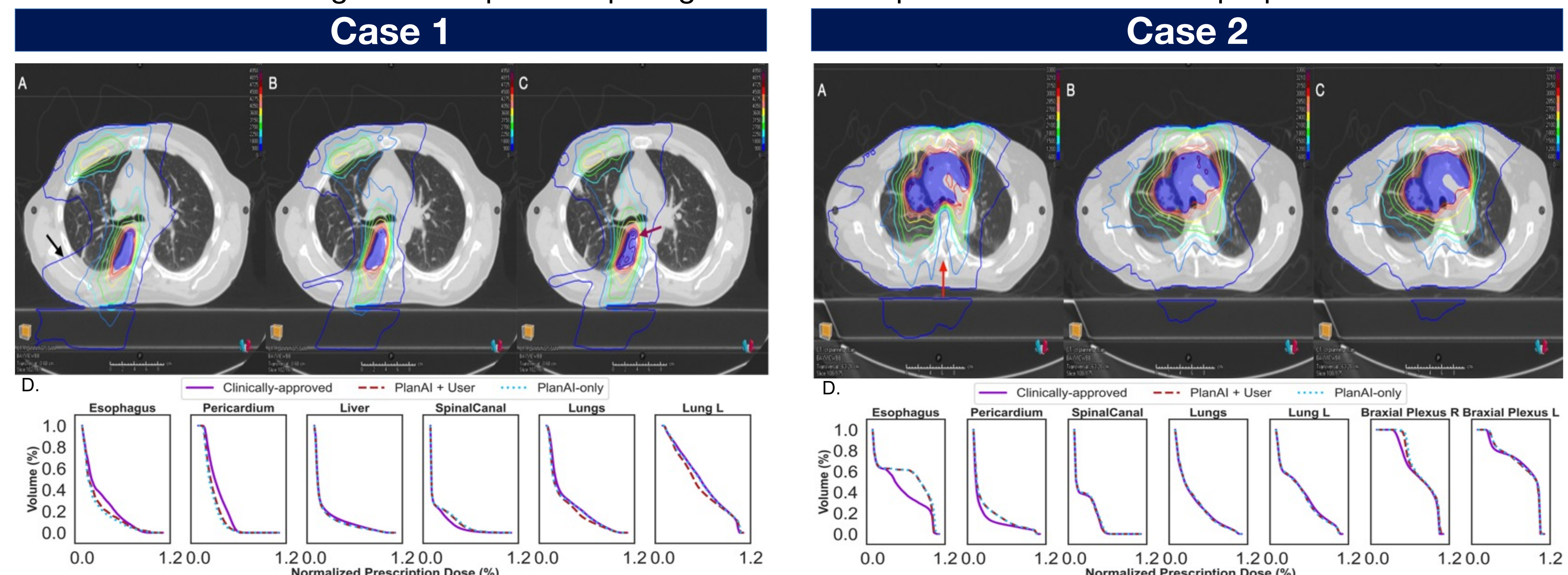


Figure 4: Isodose Distribution

(Left) Case 1: PlanAI achieves better OAR sparing with equivalent coverage. (Right) Case 2: Clinical plan provides superior OAR sparing with equivalent coverage.

A: Clinical plan; B: PlanAI + user; C: PlanAI-only; D: DVHs for key OARs.

Red arrow indicates regions of improved sparing in the clinical plan. PTV is shaded in purple.



## 6. RESULTS: SUMMARY METRICS

Table 1: PTV Coverage and Conformity Index (CI)

PTV coverage and Paddick CI

| Metric       | PlanAI | PlanAI + User | Clinical |
|--------------|--------|---------------|----------|
| PTV Coverage | 95%    | 95%           | 95%      |
| Paddick CI   | 0.66   | 0.68          | 0.69     |

## 7. CONCLUSION AND CLINICAL IMPACT



### 1. EFFICIENCY

PlanAI rapidly generates thoracic RT plans (~4 min)



### 2. QUALITY

Maintains target coverage while improving OAR sparing



### 3. CLINICAL UTILITY

Standardizes achievable DVH goals, Flags unattainable constraints, Helps anticipate planning tradeoffs



### 4. WORKFLOW

Reduces unnecessary optimization effort and streamlines clinical workflows



PlanAI predicts patient-specific, achievable DVH objectives to streamline adaptive radiotherapy planning.