

## Purpose

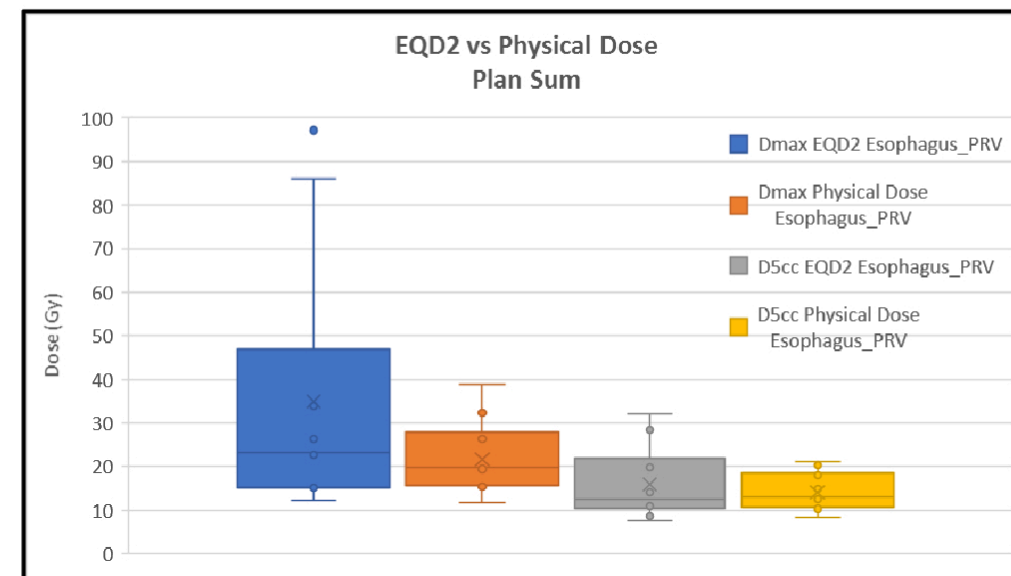
To assess cumulative organ doses after re-irradiations in SBRT lung patients using an automated clinical workflow in MIM that calculates both physical dose sum and EQD2 sum.

## Methods

Ten patient datasets, (CT, RTDOSE, RTSTRUCT, REG) from treatment courses 1 and 2, were exported from Eclipse to MIM. All patients had received one hypofractionated lung SBRT treatment plan at each course (prescriptions ranging from 7.5x8 – 18x3 (Gy x fx)). Rigid spine registration between Course 1 and Course 2 CTs (CT1 and CT2) was performed to transfer RTdose and RTstructures from CT1 to the reference set, CT2. Esophagus and Lungs were chosen for proof-of-principle, a union of the two esophagus structures was created as planning risk volume (PRVA MIM automated clinical workflow was created, calculating and displaying voxel-by-voxel physical dose-sum (PhyDose) and EQD2 dose-sum ( $\alpha/\beta = 3$  for OARs). Dmax, and D5cc for esophagus\_CT1, esophagus\_CT2 esophagus\_PRV, and mean doses and V20Gy for lungs from PhyDose and EQD2 dose-sums were compared. DICE similarity coefficients were calculated between Course 1 and Course 2 esophaguses displayed on CT2.

## Results

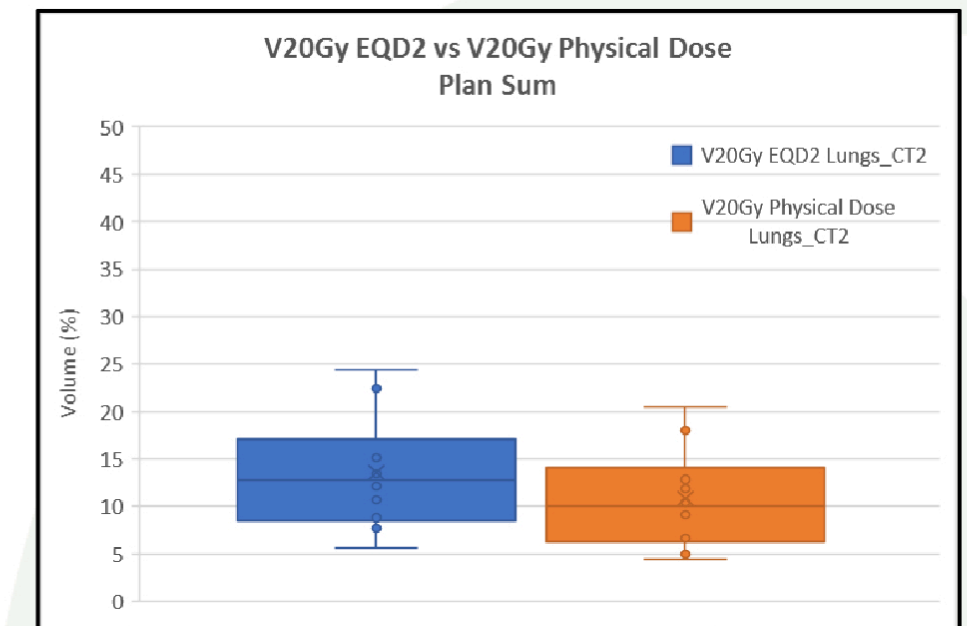
Due to a low DICE between CT1 and CT2 esophaguses ( $0.5 \pm 0.2$ ), a PRV structure was created. The median (range) Dmax EQD2 for esophagus\_PRV is 23.3 (12.2 – 97.1 Gy) and Dmax PhyDose 19.8 (11.8 – 38.8 Gy). Median (range) esophagus\_PRV D5cc EQD2 is 12.4 (7.7 – 32.1 Gy) and D5cc PhyDose 13.1 (8.4 – 21.1 Gy). Median (range) V20Gy EQD2 for lungs\_CT2 is 12.8 (5.7 – 24.4 %) and V20Gy PhyDose 10.0 (4.4 – 20.5 %).



**Figure 1.** Boxplots representing Dmax and D5cc for EQD2 and the physical dose of the plan sum for esophagus\_PRV.

**Table 1.** Dose scheme per course of SBRT treatment in all patients analyzed.

	Course 1		Course 2	
Patient (#)	Dose per fraction (Gy)	# fractions	Dose per fraction (Gy)	# fractions
1	7.5	8	18	3
2	9	5	12	4
3	10	5	18	3
4	10	5	18	3
5	18	3	12	4
6	12	4	10	5
7	10	5	18	3
8	12	4	10	5
9	12	4	10	5
10	10	5	12	4



**Figure 2.** . Boxplots representing V20Gy EQD2 and V20Gy physical dose of the plan sum for Lungs\_CT2

## Conclusion

EQD2 dose-sum volume histograms and EQD2-isodoses curves can provide more intuitive radiobiological information than physical dose-sum. A similar workflow can be used for other organs. A major limitation is that accurately including anatomical changes between courses will require deformable dose accumulation to confidently establish this automated workflow in the clinic.