facilitate shared decision making e.g. based on expected side-effects. The method was investigated for a large cohort of non-small cell lung cancer (NSCLC) patients treated with a dose-escalation protocol.

Materials and Methods: All NSCLC patients treated in 2013 with concurrent chemo-radiotherapy according to an institutional isotoxic dose-escalation protocol were included. The prescribed dose to the PTV was escalated up to 69 Gy keeping within the OAR dose constraints, e.g., a mean lung dose (MLD) of 20 Gy or a maximum spinal cord dose of 54 Gy. Patients were treated using volumetric modulated arc therapy. For 50 randomly selected patients (training cohort) the dose in the OAR voxels was calculated as function of the distance to the planning target volume (PTV). Next, for the lungs and spinal cord, the average dose-distance relation of the patients in the training cohort was calculated. For the remaining patients (validation cohort) these average-dose distance relations were used to predict dose-volume histograms (DVHs) based on the shape and orientation of the OARs and PTV. By scaling the DVHs of the OARs up to the dose constraints, the maximum achievable mean PTV dose could be predicted as well. The predicted and achieved DVHs were compared.

Results: Of the 92 patients, 88 were retrieved and analysed and four excluded due to modified OAR constraints. The training and validation group consisted of 50 and 38 patients, respectively. The difference between the predicted and achieved MLD in the validation cohort was small and statistically insignificant (0.2 ± 1.8 Gy; p = 0.45). The achieved mean PTV dose varied from 52 to 73 Gy and could be predicted correctly with an accuracy of 2 Gy for 87% of the patients. The spinal cord was dose limiting in only one patient and this was correctly predicted. Figure 1 presents the average dose-distance relations of all voxels in the lungs for the training group. The small variation in dose, especially in the region close to the PTV, emphasizes the usefulness of geometry-based plan comparison.

Conclusions: We have shown that the MLD and the prescribed PTV dose could be accurately predicted for NSCLC patients treated with arc therapy prior to the treatment planning process. This method is suitable for other treatment sites as well can be used to guide the treatment planner to achieve optimal OAR sparing or tumour dose escalation. In addition, new personalized strategies of dose escalation and shared decision making are envisioned.

OC-0253
CT characteristics allow to identify individual and regional susceptibility for radiation-induced lung damage
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Purpose/Objective: There is a huge difference in radiosensitivity of lungs between patients, which may further individualise therapy. Moreover, if regional radiosensitivities could be quantified, radiation dose redistribution will become feasible. The present study aims to identify and quantify individual and regional radiosensitivity based on a single pre-treatment CT scan (CT0).

Materials and Methods: 110 non-small cell lung cancer patients were studied: 40 treated with stereotactic ablative radiotherapy (SABR) for stage I (3x18 Gy, 4x12 Gy or 8x7.5 Gy), 40 treated conventionally (CONV1) for stage III (24x2.75 Gy sequential or 33x2 Gy concurrent with chemo), and 30 treated conventionally (CONV2) from an external validation set (30x1.5 Gy followed by 12x2 Gy). A 3 month follow-up scan (CT3M) was non-rigidly registered to CT0. Lung volumes were segmented per dose bin of 5 Gy, and their median difference in Hounsfield Units was calculated (ΔHU=HU3M-HU0). Linear and sigmoidal fits (parameters HU sat (saturation of HU) and D 50 (dose corresponding to 50% of ΔHU sat)) were made for ΔHU versus local dose, both for physical dose (D) and equivalent dose (EQD2: alpha/beta=4 Gy, proliferation rate=0.44 Gy/day).

Multivariate regression was performed for D 50 and ΔHU sat using covariates PTV volume, tumour location, heart D max, median HU in the V40 region, overall treatment time (OTT), and timepoint of CT3M. This prognostic model defining sensitive individuals was tested to define sensitive regions within one lung. Therefore, two lung subvolumes with the highest possible difference in density were manually generated on CT0 (Figure 1).

Results: Sigmoidal fits using EQD2 outperformed the other scenarios for SABR and CONV1: median sum of squares (CONV1 between brackets) of 170.0 (S17.2), 187.7 (477.5), 109.5 (326.6) and 100.7 (320.4) for linear (D), linear (EQD2), sigmoidal (D) and sigmoidal (EQD2) fits respectively. This was validated in CONV2: 685.1 and 527.5 for linear and sigmoidal EQD2 fits respectively. The distributions (in percent of patients) of D 50 and ΔHU sat reflect a large sensitivity variation (Table 1).

No prognostic factors were found for D 50, while a higher baseline lung density (p=0.004) and left lung (p=0.05) were prognostic for higher ΔHU sat.

The expected ΔHU were seen in selected subvolumes (Figure 1). Redistribution IMRT plans avoiding the high density volumes were generated. Approximately 50% of patient lungs present a composition suitable for redistribution planning.
Conclusions
Baseline CT characteristics allow to identify patient-specific and regional differences in sensitivity for radiation-induced lung damage. This may be used for further treatment individualisation.

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OC-0254
Dosimetric predictors for urinary symptoms using longitudinal endpoint and multiple events models
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Purpose/Objective: As urinary symptoms tend to recur throughout follow-up, conventional method of analysis using cumulative peak event and time-to-event may not be optimal in assessing dose-volume correlates for certain urinary symptoms endpoints. Dosimetric-symptom correlates should be supplemented by longitudinally-defined endpoints and using recurrent event models to account for multiple events per patient.

Materials and Methods: In this study, 754 dose-surface information and their corresponding specific urinary symptoms (dysuria (D), haematuria (H), incontinence (I) and frequency (F)) from a cohort of patients who received prostate radiotherapy in the RADAR TROG 03.04 trial were analysed. The dosimetric-symptom correlates were analysed using: 1) conventional methods (cumulative incidence/peak and time-to-event(Cox) analysis), 2) longitudinally-defined endpoint (mean symptoms), 3) recurrent event models using the Andersen-Gill extension of the Cox regression model for counting process (AG) & generalised estimating equation (GEE) models. Dosimetric-symptom correlates were contrasted for the different analytic methods.

Results: For dysuria and haematuria, stronger relationships were found to the dose indices using peak and Cox models compared to mean symptom, AG and GEE models. Despite the different strength of relationship, dose-surface of the bladder receiving higher than 65 Gy (S65) and S70 consistently show strong relationship to dysuria. S60 to S65 are the most significant for Hpeak, HAG, Hcox and Hmean. None of the dosimetric indices satisfy the proportional hazard assumption for HAG. For urinary incontinence and frequency, stronger relationships for dosimetric indices were found for AG, GEE and to lesser extent mean score model while both peak and Cox models do not result in significant or show trend towards significance. S35 to S40 were found to be the most significant for FGE, Fmean and FAG while S20 to S25 for IAG and Imean.

Conclusions: The use of peak or time-to-event model alone is not optimal in assessing dose-volume correlates for certain urinary symptoms endpoints. Dosimetric-symptom correlates analysis should be supplemented by longitudinally-defined endpoints and/or using recurrent event models to account for multiple events per patient.

OC-0255
Multi-variable models of acute urinary toxicity: final results of a large prospective study
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Purpose/Objective: To assess clinical and dosimetric factors affecting acute urinary toxicities on a large cohort of patients treated with external beam radiotherapy (RT) for prostate cancer with radical intent.

Materials and Methods: The final dataset of a prospective multicentre study was considered. It included 542 patients treated with conventionally (74-80 Gy at 1.8-2 Gy/fr) or