Purpose: To evaluate the accuracy of automated contour deformation for head-and-neck cancer in adaptive treatment.

Methods: Data from 13 head-and-neck patients in a phase I trial for adaptive treatment were used. Adaptation was based on [18F]FDG-PET-guided dose painting by numbers (DPBN) plans. Each patient had two DPBN plans based on: (i) a pretreatment PET/CT scan and (ii) a during-treatment PET/CT scan acquired after 8 fractions. Contours manually drawn on the pretreatment CT scan were deformed using commercial deformable image registration software onto the during-treatment CT scan. Deformed contours of regions of interest (ROI\_def) were visually inspected by an experienced radiation oncologist and, if necessary, adjusted (ROI\_def\_ad) and both sets of contours were compared to manually redrawn ROIs (ROI\_m) using Jaccard (JI) and overlap indices (OI). ROI indices and volumes were compared for all contour sets used a paired \( t \)-test and one-way ANOVA pairwise comparison, respectively.

Results: Almost all deformed ROIs in all patients required adjustment after visual inspection. The largest adjustments were made in GTVs when substantial tumor regression occurred, e.g., ROI\_def=9.2 cm\(^3\) vs. ROI\_def\_ad=2.2 cm\(^3\) vs. ROI\_m=2.1 cm\(^3\). The swallowing structures were the most frequently adjusted ROIs. The mandible was the most accurately propagated ROI requiring little or no adaptation: JI=0.7 and OI=0.8. The upper esophageal sphincter was the worst propagated ROI: JI=0.3 and OI=0.3 for the ROI\_def, JI=0.5 and OI=0.6 for the ROI\_def\_ad. Despite the variation in indices, there was no statistically significant difference between ROI\_def, ROI\_def\_ad and ROI\_m volumes. Generating ROI\_m took 4-6 hours, generating ROI\_def took a few minutes and generating ROI\_def\_ad took less than 2 hours.

Conclusions: Deformable image co-registration followed by visual inspection does require adjustment of most deformed ROIs. Nevertheless, fast automatic ROI propagation followed by user-driven adjustments appears to be more efficient than labor intensive de-novo re-contouring.