Purpose: The accuracy and reproducibility of daily patient setup is crucial, especially for highly conformal delivery techniques like Tomotherapy. We retrospectively analyzed daily setup uncertainties for six treatment sites using Tomotherapy MVCT.

Methods and Material: Translational shift data based on daily Tomotherapy MVCT registration has been analyzed for 103 patients and six sites: head/neck (n=32), brain (n=16), lung (n=16), abdomen (n=13), prostate (n=18), and pelvis (n=8). Statistical analysis included calculation of group mean shifts, and population systematic and random errors. Van Herk’s margin formula was used to calculate rigid setup error margins based on population statistics for each site. To evaluate our clinical data with respect to the community, our setup results were compared with published studies.

Results: Group mean for head/neck and brain are 0.1-0.3mm (lateral), 0.5-1.1mm (longitudinal) and 4.0-4.9mm (vertical). Amongst the different treatment sites, population systematic and random errors are smallest for head/neck and brain patients with a range of 1.4 mm to 3.0 mm, corresponding to rigid margins between 4.5 – 9.2mm. These large vertical shifts are due to couch sag and use of shims to account for thermoplastic mask shrinkage between simulation and treatment. The group mean for all other sites ranged from 0.2-1.3 mm (lateral), 0.5-3.7mm (longitudinal) and 1.9-4.1mm (vertical). Population systematic and random errors for other treatment sites ranged from 2.1-3.9mm (lateral), 2.2-5.6mm (longitudinal) and 2.6-6.5mm (vertical). This corresponds to rigid margins between 7.4-18.9mm. Comparatively, our data is similar to published data which ranges between 0.7 - 3.3mm for head/neck and brain, and 1.7 - 7.2mm for other sites.

Conclusion: Our patient setup error on helical Tomotherapy is consistent with the published literature. ACR-ASTRO guidelines recommend setting clinical tolerances for IGRT patient shifts. Currently, our institution has a 10 mm shift policy. Further analysis is needed to determine if this tolerance is appropriate for our clinic.