Purpose: Evaluate the dosimetric impact of daily setup error and inter-fraction organ motion on the radiation treatment plan.

Methods: Twelve patients undergoing definitive IMRT treatments for prostate cancer were evaluated. All patients underwent fiducial marker placement prior to treatment planning CT scan, and were treated to a dose of 8100cGy given in 45 fractions. We retrospectively created a plan for each treatment day that had a shift available. To calculate the dose the patient would have received with no setup correction, we mathematically 'negated' the shift by moving the isocenter in the opposite direction of the shift. The individualized daily plans were combined to generate an overall plan sum. The dose distribution from these uncorrected plans was compared to the actual treatment plans.

Results: A total of 390 shifts were negated and their corresponding plans evaluated. The mean isocenter shift based on the location of the fiducial markers was 3.3±6.5mm to the right, 1.6±5.1mm posteriorly, and 1.0±5.0mm along the caudal direction. The mean D95 dose when setup error was corrected and uncorrected for the PTV8100 volume was 8089cGy and 7303cGy (p < 0.001) and for prostate volume was 8228cGy and 7844cGy (p < 0.002). The mean V95 values when setup error was corrected and uncorrected for the PTV8100 volume was 99.9% vs. 87.3% (p < 0.0001). At an individual level, the difference in D95 value approached 1200cGy for the prostate volume and 2000cGy for the PTV8100 volume. There was no statistically significant difference in the D35 parameter for the surrounding normal tissue except for the dose received by the right hip and the penile bulb.

Conclusion: This work indicates that significant underdosing, approaching 2000cGy for the PTV8100 volume, can occur as a result of inaccurate patient setup, and emphasizes the importance of accurate patient setup and target localization.