Purpose: During the course of radiotherapy random uncertainties in patient positioning and the fluctuation of machine parameters are inevitable. In this study we compared the impact of these errors on the quality of delivered Volumetric Modulated Arc Therapy and Intensity Modulated Radiation Therapy prostate plans.

Methods: VMAT and IMRT plans were generated for two representative contour sets in Pinnacle. The uncertainty in patient setup and machine parameters during delivery was simulated by introducing random errors in isocenter position, MLC leaf positions and gantry angles for each fraction of the treatment. Random error ranges of ±3mm, ±1mm and ±1deg were used for isocenter position, MLC leaf positions and gantry angles respectively. The simulated plans were recalculated in Pinnacle and the impact of random errors on the plan quality was studied by comparing the Dose Volume Histogram of target volumes and OARs for both VMAT and IMRT plans.

Results: The introduction of random errors resulted in dose smearing of both VMAT and IMRT plans. Less than 1% difference in the dose to the CTV was seen between the planning and error simulated plans for both VMAT and IMRT. However the difference in dose between the planned and error simulated plans for the PTV was greater for VMAT compared with IMRT. The V95 of PTV was reduced by less than 1% for IMRT, whereas a difference of up to 2% was observed in VMAT. A variation of less than 1% in EUD for both the rectum and bladder was observed between the planned and error plans for both VMAT and IMRT.

Conclusions: VMAT plans are relatively more sensitive to random errors in treatment delivery and patient positioning compared to IMRT plans when considering dose to the PTV, however only small variations are seen in both the CTV and OARs for both VMAT and IMRT plans.