Purpose: Once implanted, prostate brachytherapy seeds are vulnerable to loss and movement. A general estimation of these effects may be useful for making patient care decisions when seeds are lost after the post-implant scan. The goal of this work was to explore the dosimetric and radiobiological effects of the types of seed loss and migration common in prostate brachytherapy.

Methods: This study evaluates five patients. For each, three treatment plans were created using Iodine-125, Palladium-103 and Cesium-131. The three seeds closest to the urethra were identified and modeled as seeds lost through the urethra. The three seeds closest to the exterior of prostatic capsule were identified and modeled as those lost from the prostate periphery. The seed locations and organ contours were exported from Prowess and used by in-house software to perform the dosimetric and radiobiological evaluation. The radiobiological evaluation was based on the linear-quadratic model. Seed loss was simulated by removing 1, 2 or 3 seeds near the urethra 0, 2 or 4 days after the implant or removing seeds near the exterior of the prostate 14, 21 or 28 days after the implant.

Results: Loss of 1, 2 or 3 seeds through the urethra resulted in D90 reduction of 2%, 5% and 7% loss respectively. Due to delayed loss of peripheral seeds, effects were less severe than for loss through the urethra. However, while the dose reduction is modest for multiple lost seeds, the reduction in tumor control probability was minimal.

Conclusions: The goal of this work was to explore the dosimetric and radiobiological effects of the types of seed loss and migration commonly seen in prostate brachytherapy. The results presented show that loss of multiple seeds can cause a substantial reduction of D90 coverage. However, the dose reduction was not seen to significantly reduce tumor control probability.