

AbstractID: 11279 Title: Simulation of the risk of developing a second cancer due to the scattered radiation for different treatment modalities at different sites.

**Purpose:** Pediatric patients undergoing radiation therapy receive higher doses at organs and tissues lateral to the primary field edge and stand a higher risk of developing secondary cancers during the span of their longer post treatment lives. There is a concern in particular for modern treatment techniques, like IMRT or proton therapy. Consequently, we did extensive simulations on organ specific equivalent doses.

**Method and Materials:** Age and gender specific whole-body phantoms (an adult, a 9 month old male, a 4-year old female, an 8-year old female, an 11-year old male, and a 14-year old male) have been implemented in Geant4 in order to determine the doses from the secondary radiation in patients undergoing proton and IMRT treatments. We have used several fields planned for different treatment sites (head & neck, abdominal) to determine the secondary organ doses. Lifetime attributable risk (LAR) is also determined based on two risk models, namely, excess relative risk and excess absolute risk.

**Results:** For passive scattered proton therapy, neutron equivalent doses to various organs are dominated by the treatment head contribution for small fields and by the patient contribution for large fields. Passive scattered proton therapy and scanned beam proton therapy were simulated separately. The maximum dose organs received in the spinal field was 8.5mSv/Gy. Simulated LAR for passive scattered proton therapy for an 8-year old female and 11-year old male patients for the lung are found to be 1.05% and 0.38%, respectively.

**Conclusions:** We find the scattered photon and neutron doses to various organs and tissues decrease with phantom age and it depends on the field size. Breast in female and lung/bronchi in male patients show the largest risk but also the baseline values for these organs are the highest. For most organ the risks are below the baseline risk.