Purpose: To determine the optimal prescription isodose line that minimizes normal tissue irradiation for stereotactic radiation therapy comparing conventional linear accelerator and robotic delivery.

Methods: A computer based digital torso phantom which has the capability to simulate respiratory and cardiac motion were used in this study. Spherical targets were constructed in lung and liver, with diameter of 20mm, 30mm, and 40mm. Two concentric 5mm shells, from the target surface extending 5mm radially and from 5mm to 10mm, were identified/contoured. Noncoplanar, non-opposing 3D conformal beams were designed for linac planning. Variable prescription isodose lines were achieved by varying the block margin. 4D dose calculation was used for moving target and surrounding tissue. After linac planning, the CT images and contours were transferred for Cyberknife® planning. Variable prescription isodose lines were achieved by inverse planning technique. Doses of 60Gy in 3 fractions were prescribed to cover exactly 95% of target tumor with each technology. gEUD (generalized effective uniform dose) with different formulations for parallel and serial tissues was used for comparison between different plans.

Results: For linac plans, the optimal prescription isodose line yielding maximum normal tissue sparing occurs between 50% and 70% for the lung tumor and 60% and 90% for liver tumor. The gEUD difference between plans with optimum and arbitrarily chosen prescription isodose line may be up to 20% of prescription dose. For Cyberknife plans, the optimal prescription isodose line is approximately 50% for tissues displaying either parallel or serial behavior. These results are similar for different tumor sizes.

Conclusions: Both conventional linac and Cyberknife® delivery can provide conformal tumor coverage with normal tissue sparing. By carefully choosing the optimal prescription isodose line, the gEUD of the surrounding normal tissue can be reduced by up to 20% of prescription dose.