

AbstractID: 7649 Title: Statistical Distribution of Strengths for Various Models of Low Energy Permanent Brachytherapy Sources

Purpose. Because there is limited data on the distribution of seed strengths across many source models available, this study determines the standard deviation of source strengths in actual brachytherapy seed orders. Additionally, we test a recent analysis indicating that the number of assayed seeds necessary to determine an accurate sample mean depends only on the deviation of source strengths within the order.

Methods. Thirty consecutive orders for each of five I-125 source models and three Pd-103 models were analyzed by 100% assay of single seeds in well chambers with appropriate ADCL calibration factors.

Results. The aggregate distribution of source strengths as percent deviation from the mean for each model was normal. The strength distribution of individual orders was usually normal, but some were skewed left or right and some were rectangular. The average order consisted of 96 seeds and 109 seeds for I-125 and Pd-103, respectively. For the I-125 models, the average standard deviation from the mean ranged from 2.3% to 3.8%, and for Pd-103 models from 1.1% to 1.8%. An iterative assay was tested in a 30 patient Pd-103 model series where the average number of seeds was 119. The standard deviation of strengths was calculated with each additional seed and stopped when the mean was predicted to be within 3% of the population mean at the 95% CI. The mean number of seeds assayed was 2.8, and only one order required 5 seeds. The mean seed strength agreed within 0.5% of the 100% assay and a maximum absolute difference of 2.2%.

Conclusion. The seed strength variation found for the models studied is acceptable for an iterative assay approach that determines the number of seeds to be assayed by the standard deviation of the seed order. Such an approach requires considerably fewer seeds than the 10% assay approach.