Purpose: This study demonstrates new methods for treatment plan evaluation and comparison. The clinical importance of these methods is examined in relation with standard radiobiological and dosimetric treatment plan evaluation criteria.

Methods: Typical head and neck, breast and prostate cancer cases were selected to quantify the benefits of the proposed treatment plan evaluation method. In each case, conformal radiotherapy (CRT) and IMRT treatment plans were produced. The different treatment plans were evaluated based on the dose distribution converted to D2Gy, iso-probability and iso-BED dose charts and corresponding probability volume histograms.

Results: For the head & neck cancer case, at the prescribed dose level of the CRT and IMRT dose distributions, the P+ values are 0.0% and 24.9% for a BEUD to the target of 54.6 Gy and 63.5%, respectively. For the breast cancer case, the P+ values are 88.0% and 89.1% for a BEUD of 61.6 Gy and 61.4%, respectively. For the prostate cancer case, the P+ values are 28.7% and 51.3% for a BEUD of 69.3 Gy and 70.7%, respectively. The use of local iso-probability charts is very useful for plan evaluation since the visual information focuses on the doses that may cause an effect in a particular organ by considering its radiosensitivity. Also, since these low doses may not have an actual clinical effect, the dosimetric information provided by low doses in the normal tissues is reduced eliminating some visual noise. At the same time, cold spots in the target volumes and hot spots in the normal tissues are immediately visualized.

Conclusions: The proposed D2Gy, iso-probability and iso-BED dose charts and histograms illustrated better the difference in the effectiveness of the different treatment plans, which shows the benefits that these evaluation tools can offer in the process of treatment planning.