Purpose: Prostate cancer is the most prevalent cancer among males in the US, and over 90% of patients develop bone metastases. Current treatment response evaluation metrics, such as RECIST, are not suited for assessing bone lesions. The aim of this work is to present an automated segmentation method that identifies and characterizes bone lesions and determine its sensitivity to thresholding.

Methods: Patients with metastatic prostate cancer were treated with molecular target therapy and received whole body [F-18]NaF (bone imaging) PET/CT scans during the course of treatment. Scans were evaluated using the Quantitative Total Bone Imaging (QTBI) methodology, which assesses total bone and individual bone lesions in patients with bone metastases. Individual lesions were segmented using thresholds ranging from 20% to 80% of the maximum standardized uptake value (SUV) in bone. The mean SUV, total SUV, and volume of the total bone and individual lesions were determined as well as the number of lesions. Treatment response was assessed as the percent change in the imaging metrics relative to pre-treatment.

Results: The QTBI methodology was able to identify and characterize bone lesions. Of the treatment response metrics, change in number of lesions showed the greatest dependence on the threshold. The standard deviation of patient responses ranged from 13.5 to 34.5. Change in mean SUV had the least sensitivity to threshold (SD=0.5-2.0). Change in total SUV and volume both showed intermediate variation (SD=7.5-11.5 and 11.0-12.5, respectively).

Conclusions: The QTBI methodology is able to identify and characterize bone lesions. However, because most imaging metric responses vary with different thresholds, careful selection of SUV threshold for segmentation is necessary to accurately identify and characterize bone lesions and assess treatment response. With further refinement, this methodology can be a clinically useful tool to improve patient care and test new therapies for use in metastatic bone disease.