78 APPLICATION OF NOVEL AI-ASSISTED TECHNOLOGY IN ^{18}F-FDG PET-CT SCAN ANALYSIS – PREDICTING DISEASE RESPONSE IN METASTATIC MELANOMA PATIENTS UNDERGOING IMMUNOTHERAPY

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Background Immunotherapy has proven its ability to yield durable responses in patients with metastatic melanoma, as evidenced by the findings from ^{18}F-FDG PET-CT medical imaging. By leveraging the valuable information embedded in scans conducted early in the treatment process, there is potential to predict treatment effectiveness based on biomarkers of responding disease. This study applied novel AI-assisted technology to automatically extract features from ^{18}F-FDG PET-CT images that correlate with the first line of immunotherapy and heterogeneity of disease and response to create a scoring system.

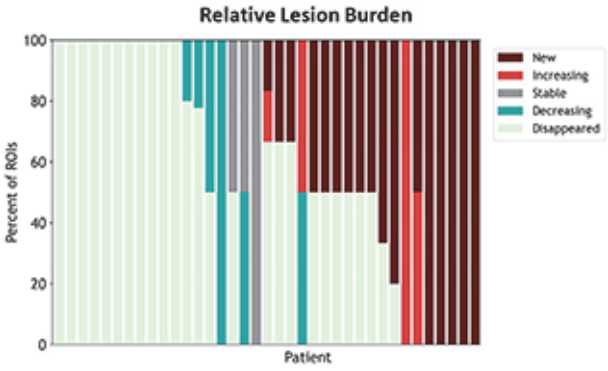
Methods Pre-immunotherapy (baseline) and the first follow up ^{18}F-FDG PET-CT scans from 44 patients with metastatic melanoma were retrospectively collected between 2013 and 2022 (under an IRB approved protocol). The response to first line of immunotherapy was reported as stable disease, progressing disease or complete response. TRAQinform IQ analysis software (AIQ Solutions, Madison, WI) was used to analyse independent ^{18}F-FDG PET-CT scans. TRAQinform IQ is a fully automated software that detects, track and computes changes of individual regions of interest (ROI) across multiple timepoints. Imaging features were input into the TRAQinform Profile, which used a 5-folds cross-validation of a random survival forest to predict time on immunotherapy. Univariate predictive power of metrics was assessed using Cox proportional hazards regression. Predictive power of individual metrics and TRAQinform Profile were evaluated using the c-index.

Results The patient population included 25 male and 19 females, average age 66 (range 23–85). Patients first line immunotherapy was pembrolizumab (28), ipilimumab (3), nivolumab (5) and ipilimumab + nivolumab (8). Overall, 31 patients had complete response, 10 patients progressing disease and 3 patients had stable disease. Heterogeneity of change in ROI was observed in 12/44 patients (figure 1). The top univariate predictors of response based on time to progressions were, change in uptake heterogeneity (c-index=0.73), heterogeneity of uptake at baseline (0.69), SUV_{total} at baseline (0.68), number of decreasing regions (0.68) and number of regions at baseline (0.68). TRAQinform Profile resulted in the highest predictive power (c-index=0.75).

Conclusions This study demonstrates that an AI-assisted immunotherapy response analysis can help predict disease response using quantitative features from ^{18}F-FDG PET-CT imaging of patients with metastatic melanoma undergoing immunotherapy. These results support further investigation into individual outcomes, type of immunotherapy and warrants future studies to validate these findings in a prospective cohort.

Ethics Approval Ethics was approved under IRB protocol for this study. Written informed consent was obtained from the patient for publication of this abstract. Human Research Ethics Committees approval include Edith Cowan University (No. 11543), Sir Charles Gardner Hospital (No. 2013–246) and WA Health (RGS0000003289).

Consent Written informed consent was obtained from the patient for publication of this abstract.



Abstract 78 Figure 1 Heterogeneity assessment of 37 patients' images with ^{18}F-FDG PET-CT (7 patients had no ROI detected and therefore were excluded). Each patient is a column divided into colors representing% of lesions each response category.

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