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Comprehensive assessment of ^{18}F-FDG PET/CT images of cancer patients improves predictions of survival

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INTRODUCTION

Standardized reporting of treatment response in oncology patients has traditionally relied on RECIST [1] and PERCIST [2]. Assessment of the limited number of lesions (up to 5) prevents a comprehensive evaluation of treatment response heterogeneity that most patients experience. The central hypothesis of our study was that **a more complex evaluation of all lesions improves outcome prediction.**

MATERIALS AND METHODS

- 385 patients imaged with ^{18}F-FDG PET/CT were analyzed in this study (Table 1)

Table 1: Patient characteristics

Cancer type	Patients	Treatment	Imaging timepoints	Number of imaging sites
Non-small cell lung cancer (NSCLC)	115	Chemoradiotherapy	Baseline and 12-16 weeks post-treatment	37
Head and neck cancer (HN)	142	Chemoradiotherapy	Baseline and 12 weeks post-treatment	1
Diffuse Large B-Cell Lymphoma (DLBCL)	128	Combinations of chemotherapy	Baseline and 17-21 days post cycle 2	47

- Comprehensive evaluation of manually generated regions of interest between timepoints was performed using AIQ Solutions' TRAQinform IQ technology, classified each ROI as new, increasing, stable, decreasing, and disappearing, based on changes in total lesion glycolysis
- 88 imaging features were extracted from each patient (including SUVmax, SUVpeak, total lesion glycolysis, and intra-patient heterogeneity features)
- The TRAQinform Profile was defined as the output of random survival forest models that predicted overall survival in each cancer type, evaluated with 3-fold cross validation
- The predictive accuracy of the AIQ TRAQinform Profile was compared to fully automated RECIST and PERCIST values using Kaplan-Meier analysis

RESULTS

- **TRAQinform Profile had a significant survival prediction in NSCLC (p<0.0001), HN (p<0.0001), and DLBCL (p=0.005)** (Figure 1, column 1)
- RECIST or PERCIST performed well in HN (p=0.0004 and p=0.007, respectively), but did not reach statistical significance (p>0.05) in NSCLC or DLBCL (Figure 1, columns 2 and 3)

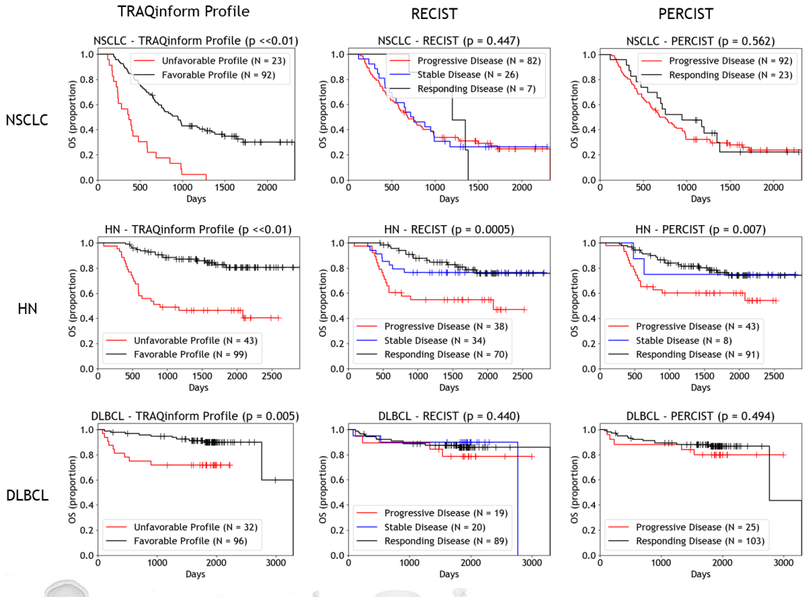
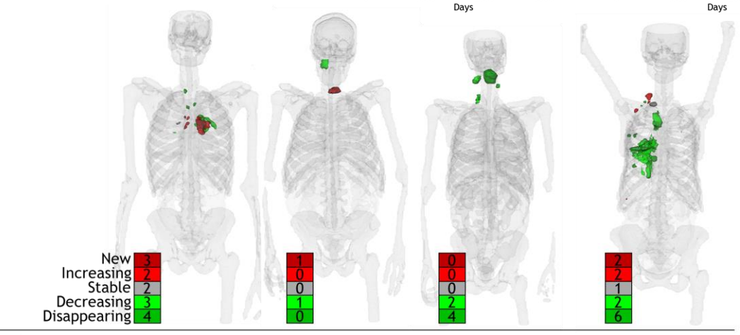


Figure 1: Kaplan-Meier comparison of TRAQinform Profile analysis with RECIST and PERCIST. Log-Rank tests were used to compare survival across groups.



Metric				
Overall Survival	2149 days	2145 days	584 days	417 days
TRAQinform Profile	Favorable	Favorable	Unfavorable	Unfavorable
RECIST	PD	PD	PR	PD
PERCIST	PMD	PMD	PMR	PMD

Figure 2: TRAQinform IQ analysis of 4 example patients, sorted by decreasing overall survival. TRAQinform Profile, RECIST, and PERCIST classification of each patient is described. Partial response (PR/PMR) on RECIST and PERCIST did not mean longer survival than progressive disease (PD/PMD).

DISCUSSION

While RECIST and PERCIST have utility in drug development, they are insufficient at predicting survival in individual patients with multiple lesions.

Due to their focus on target lesions or new lesions, automated RECIST and PERCIST were not able to separate patients with shorter survival than those with longer survival, except for in head and neck cancer patients.

Comprehensive assessment of all lesions, as attempted in the computation of the TRAQinform Profile, is necessary for accurate prediction of clinical outcomes.

DISCLOSURES

GL and RJ are cofounders of AIQ Solutions.

ML, AW, SH, OL, and TP are employed by AIQ Solutions.

REFERENCES

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[2] Wahl RL, Jacene H, Kasamon Y, Lodge MA. From RECIST to PERCIST: Evolving Considerations for PET response criteria in solid tumors. J Nucl Med. 2009;50 Suppl 1(Suppl 1):122S-50S.

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