

Development of a Visually Calculated SUVmean (HIT Score) on Screening PSMA PET/CT to Predict Treatment Response to [¹⁷⁷Lu]Lu-PSMA Therapy: Comparison to Quantitative SUVmean and Patient Outcomes

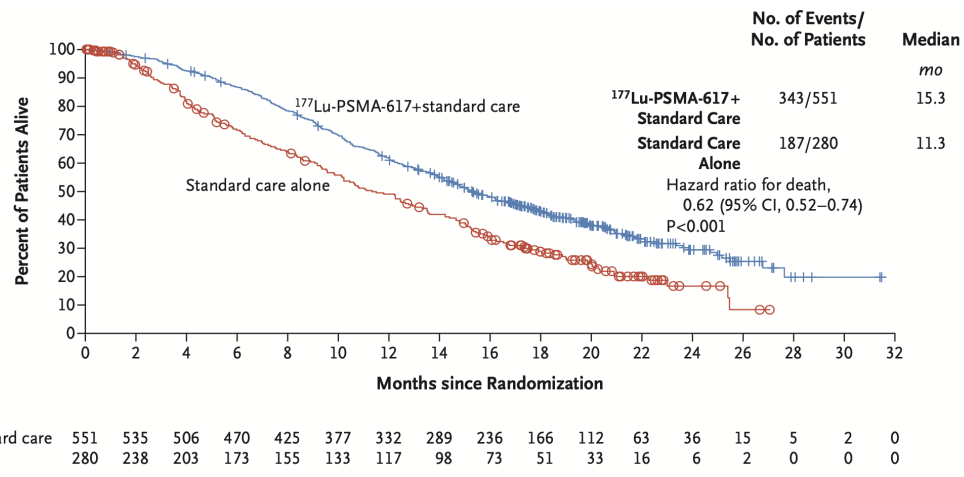
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No disclosures

BACKGROUND



- [¹⁷⁷Lu]Lu-PSMA-617 improves overall survival (OS) in men with metastatic castrate resistant prostate cancer (mCRPC) post androgen receptor pathway inhibition and taxane chemotherapy (1).

[1] Sartor O, et al. N Engl J Med. 2021;385:1091-1103.

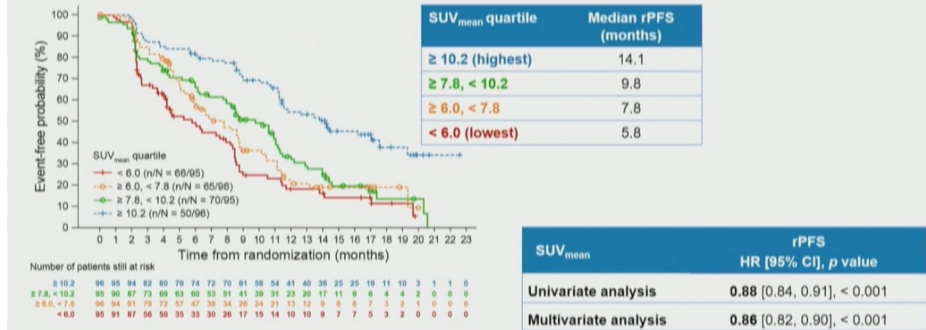
BACKGROUND

- Semi-quantitatively derived SUV_{mean} on screening PSMA PET is predictive of treatment response with [¹⁷⁷Lu]Lu-PSMA-617 (2, 3).
- However, deriving SUV_{mean} requires dedicated software programs not currently clinically available.

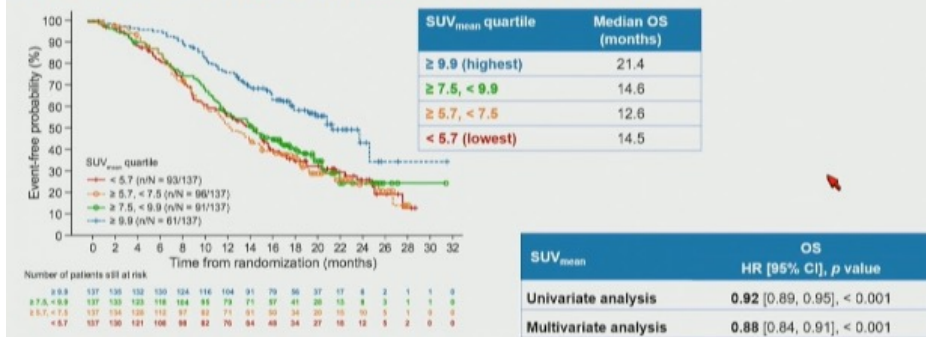
[2] Kuo PH, et al. JCO Oncol Pract. 2022;5002.

[3] Buteau JP, et al. Lancet Oncol. 2022;23:1389-1397.

• Higher whole-body SUV_{mean} was associated with prolonged rPFS



• Higher whole-body SUV_{mean} was associated with improved OS





AIM

- To develop a reproducible visual scoring system encompasses the elements of SUVmean, without requiring additional quantification
- **Intensity**
- **Heterogeneity**

METHODS

- Datasets of patients from 3 published trials of [¹⁷⁷Lu]Lu-PSMA therapy in patients with mCRPC.
 - Re-SPECT clinical registry
 - LuPIN prospective phase I/II trial
 - Lu-PSMA prospective phase II pilot trial
- Retrospective quantitative and visual analysis of screening [⁶⁸Ga]Ga-PSMA-11 PET/CT
- Correlation to patient outcomes: PSA 50% response rate, PSA-PFS and OS.

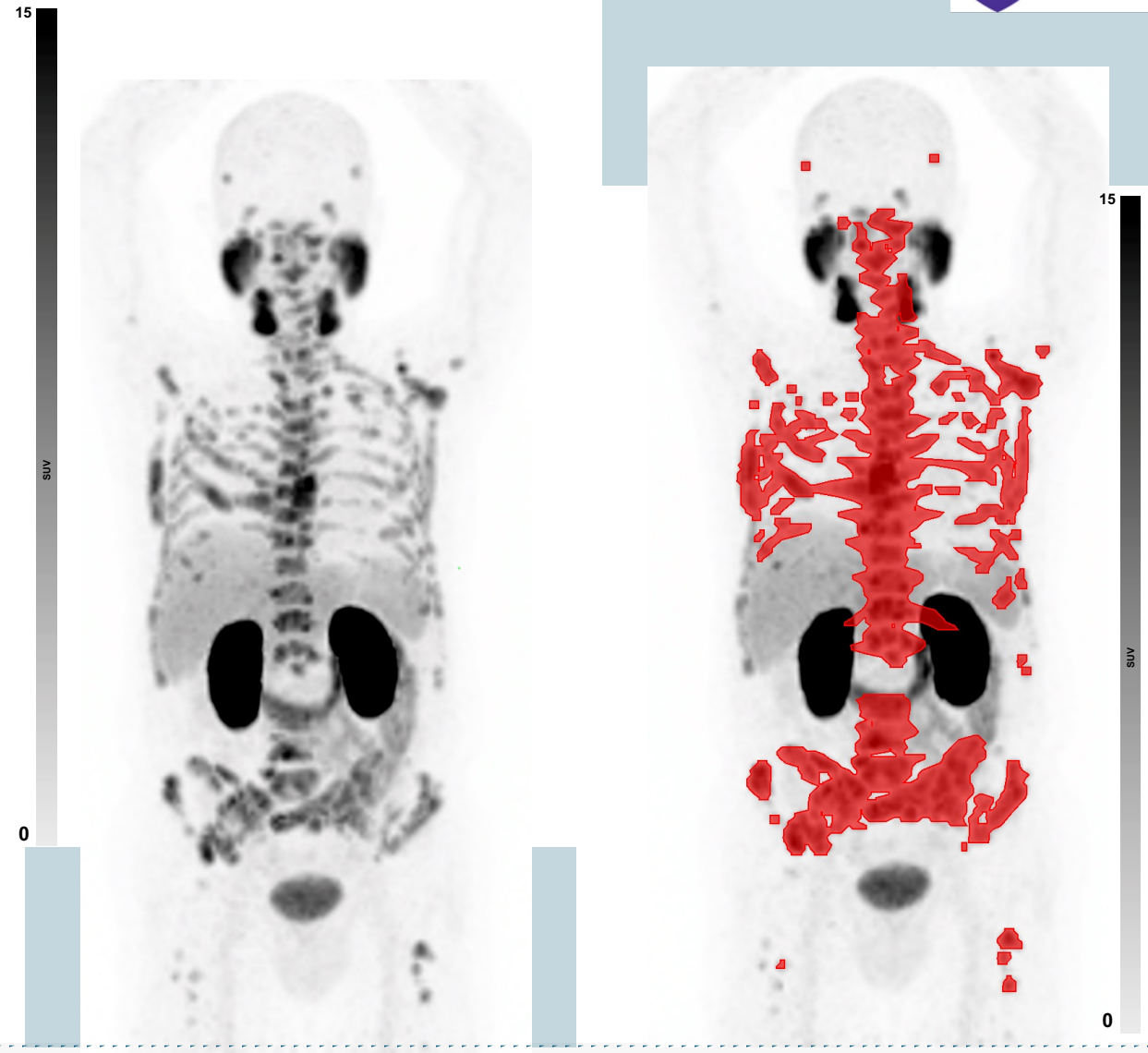
[4] John N, et al. J Nucl Med. 2023;64:410-415.

[5] Crumbaker M, et al. Eur Urol Oncol. 2021;4:963-970.

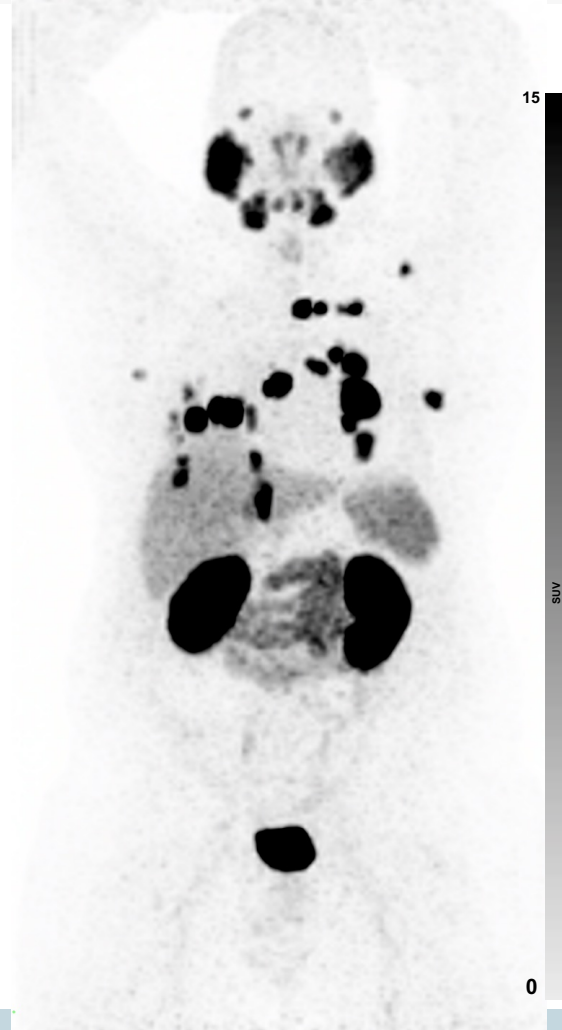
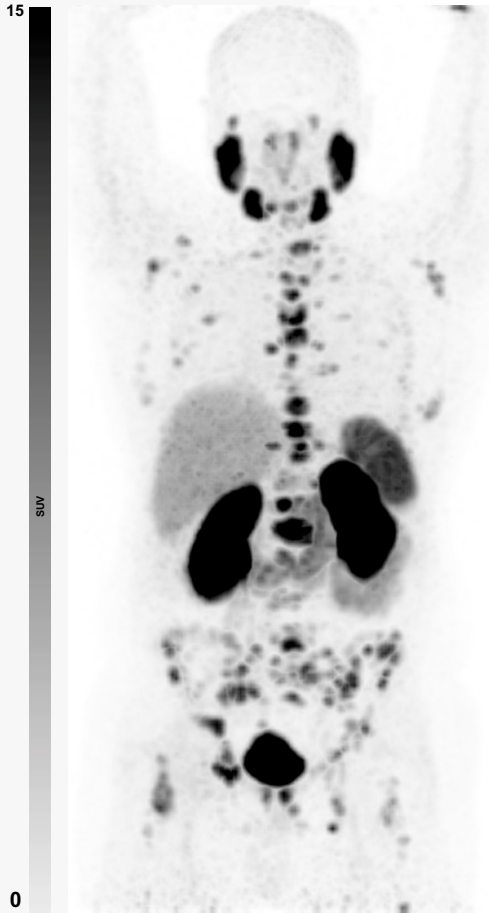
[6] Emmett L, et al. Clin Genitourin Cancer. 2019;17:15-22.

METHODS

- Semi-quantitative analysis using MIM encore was used to derive total body SUVmean.



Heterogenous



Homogenous

METHODS

Visual assessment of **heterogeneity** on the

- Rotating 3D MIP images (SUV window 0-15).
- The fused PET/CT images.
- Concurrent contrast enhanced CT imaging to identify PSMA negative sites of disease.

METHODS

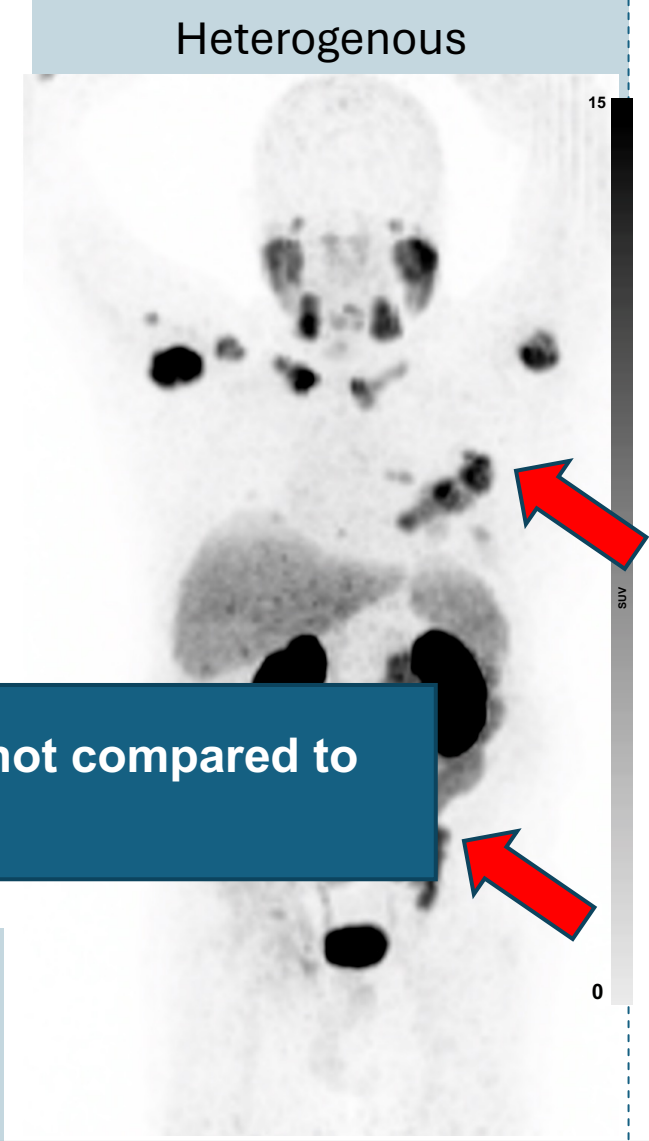
- Binary visual heterogeneity score to determine heterogenous or homogenous
- If more than 20% of larger lesions had variable intensity (inter or intra-lesional), this was classified as **heterogeneous**

Heterogeneity was determined between lesions and within lesions – not compared to parotid or liver

- have uniform intensity. This was classified as homogenous.



Homogenous



Heterogenous

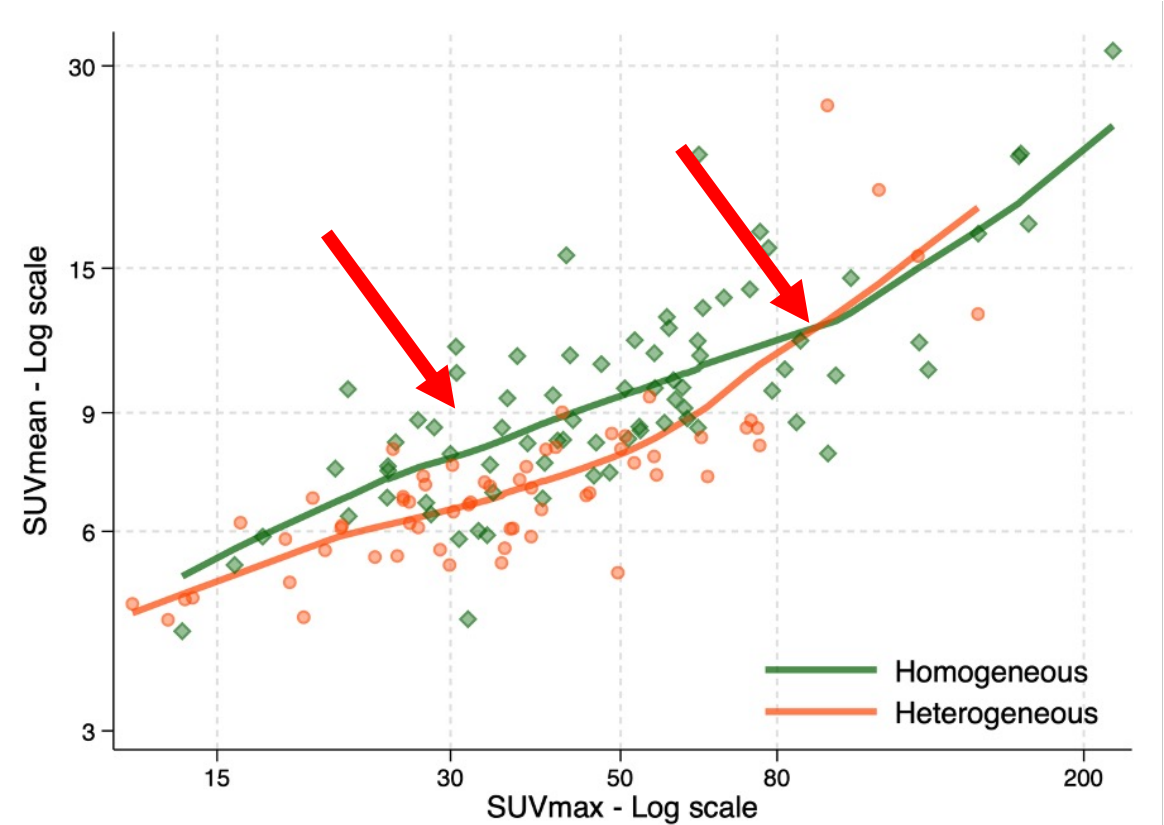
METHODS

SUVmax of the most intense lesion was used as a measure of **PMISA intensity**.

Readers allocated an SUVmax range (<15, 15-29, 30-49, 50-79, ≥ 80).

METHODS

- Modelling of data including heterogeneity and SUVmax range to quantitative SUVmean.
- A **4-point scale** incorporating both heterogeneity and intensity of tumors (**HIT**) was determined to optimally stratify patient outcomes.



Scatterplot of weighted regression curves of log SUVmean vs SUVmax range, by visual heterogeneity score (Homogeneous vs Heterogeneous).

METHODS

Score 1: SUVmax <15, score 2: SUVmax range 15-79 + heterogeneous, score 3: SUVmax range 15-79 + homogenous, score 4: SUVmax range ≥ 80 .

	Intensity (SUVmax)				
	< 15	15-29	30-49	50-79	≥ 80
Heterogeneous	4	20	23	11	4
Homogeneous	1	14	24	25	13

HIT score (1-4) color-coded table incorporating SUVmax range (most intense lesion) and binary visual heterogeneity with patient numbers in each group (total n = 139).

RESULTS

139 patients had screening PSMA PET/CT analyzed
Median 4 doses [¹⁷⁷Lu]Lu-PSMA of 7.5 GBq.

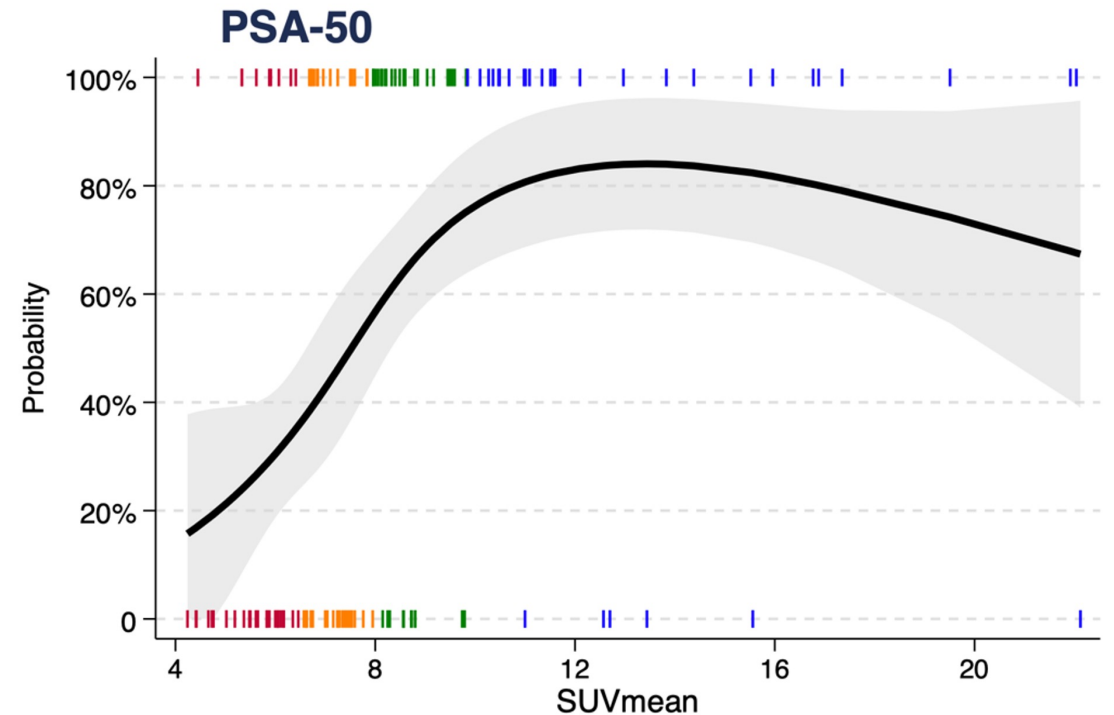
Overall PSA50 was 54%

Median PSA-PFS 5.5 months (95%CI: 4.1 – 6.0)

Median OS 13.5 months (95%CI: 11.1 – 17.9).

PSA50

- Increasing SUVmean was associated with higher PSA50.
- The PSA50 for a HIT score of 1 through 4 was 0% (0/5), 39% (21/54), 65% (41/63), and 76% (13/17), respectively.

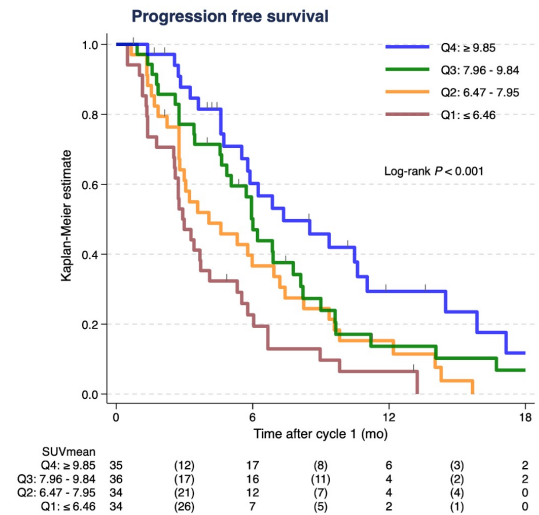


Probability of PSA50 response rate according to quantitative SUVmean (continuous variable).

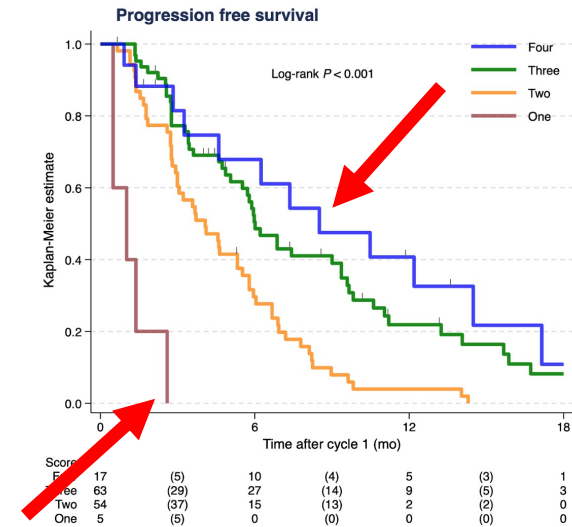
PSA Progression-free survival

- Both SUVmean quartiles and HIT score statistically significantly predicted PSA-PFS (log-rank $P < 0.001$)
- The median PFS for HIT score 1 through 4 was 1.0, 4.1, 6.0, and 8.5 months, respectively.

SUVmean PSA-PFS



HIT score PSA-PFS

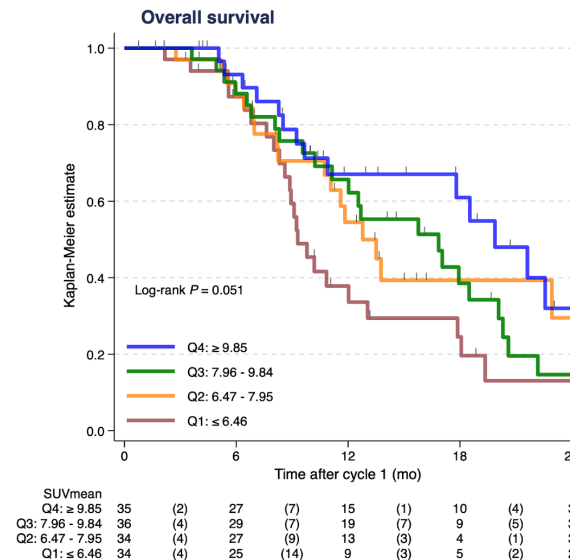


Kaplan Meier curve (log-rank tests) of PSA-PFS (A) for SUVmean (B) for one through four HIT score.

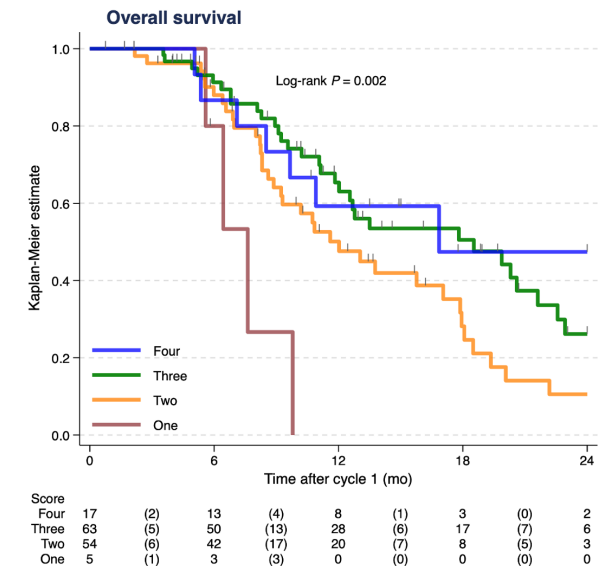
Overall Survival

- SUVmean quartiles showed borderline correlation for OS ($P=0.051$)
- However, HIT score showed significant correlation for OS (log-rank $P=0.002$).
- The median OS for HIT score 1 through 4 was 7.6, 12.0, 18.5, and 16.9 months.

SUVmean OS



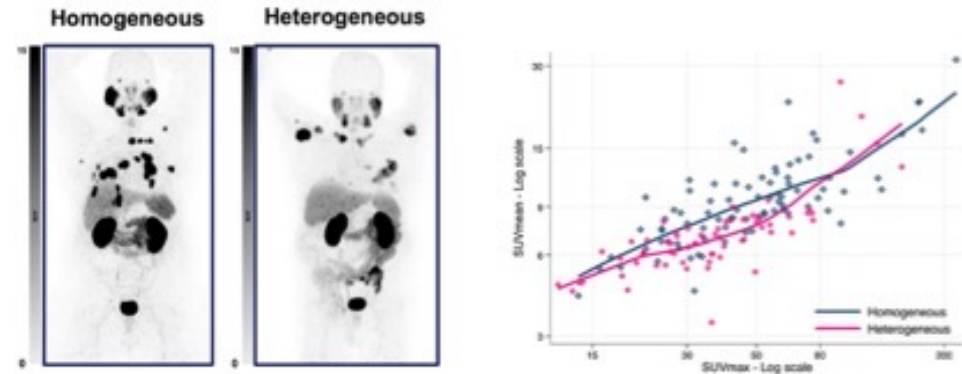
HIT score OS



Kaplan Meier curve (log-rank tests) of OS (A) for SUVmean (B) for one through four HIT score.

RESULTS

- HIT score and SUVmean quartiles showed comparable predictive power for
 - PSA-PFS (Somers' D= 0.25 vs 0.27)
 - OS (0.15 vs 0.16)
- HIT score predictive power exceeded those for SUVmax range quartiles (PFS=0.17, OS=0.12).
- The inter-rater agreement (Cohen's kappa) of the HIT score was substantial at 0.71 (95% CI: 0.60 – 0.82) and percentage agreement was 82%.



$$f(\text{Visual SUVmean}) = \sum (\text{Heterogeneity}) + \int \text{Intensity}$$

CONCLUSION

- A PSMA PET/CT score incorporating both heterogeneity and intensity of tumors (HIT) derived from tools on a standard PET workstation, is comparable to quantitative SUVmean as a prognostic tool following [¹⁷⁷Lu]Lu-PSMA therapy.
- Further studies are warranted to validate the clinical utility of the HIT score.

A photograph of St Vincent's Hospital building under a clear blue sky. The building is a multi-story structure with a modern facade of light-colored panels and large windows. A purple logo is visible on the building's facade. In the foreground, there is a parking area with several signs: a red 'NO STOPPING' sign with a right-pointing arrow, a red 'AUTHORISED VEHICLES ONLY' sign, and a red 'RESTRICTED PARKING AREA' sign. A white ambulance is parked in the driveway. To the right, a white sign with a black 'P' and 'PARKING' text is visible. The scene is lit by bright sunlight, casting shadows on the building and the ground. A large tree is on the left side of the frame.

 St Vincent's Hospital

THANK YOU