

Utility of PET-CT for nodule discrimination in the SUMMIT Study

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GRAIL

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The SUMMIT Study

- The SUMMIT Study aims to assess implementation of LDCT screening for lung cancer in a high-risk population, and validate a multi-cancer early detection blood test
- Prospective cohort study
- Operational from 2019 – 2023
- Total number of participants recruited: 13,035
- Annual vs biennial LDCT (3 annual visits)
- Inclusion: Age 55-77, meet USPSTF (2013) or PLCOm2012 6 year lung cancer risk $\geq 1.3\%$
- Participants with suspected malignant nodules were referred for further investigation via 2 week wait to their local hospital
- Further work up was directed by local Lung Cancer multi-disciplinary teams according to usual clinical practice

Utility of PET-CT

- PET-CT usually performed to evaluate clinically detected pulmonary nodules $\geq 8\text{mm}$ that have remained stable after interval CT imaging
- Additionally, it is a non-invasive method of mediastinal staging and exclusion of metastases in suspected early-stage lung cancer
- However, role in the evaluation of screen detected nodules is yet to be determined
- We examined the outcomes for participants who have undergone at least one PET-CT as part of the investigative pathway
 - Outcomes were collected via SUMMIT study database, National Cancer Registration and Analysis Service (NCRAS) and electronic record review

Cohort summary

Participants referred to Lung Cancer MDT who have subsequently undergone at least one PET-CT which shows a persisting nodule

Total n = 662

	Frequency (n)	Percentage (%)
Gender		
Female	316	48
Male	346	52
Age groups		
55-59	82	12
60-64	123	19
65-69	178	27
70-74	189	29
≥75	90	14
Ethnicity		
White	586	89
Asian	42	6
Black	11	2
Mixed	13	2
Other	10	2
Smoking status		
Former smoker	336	51
Current smoker	326	49
Median pack years	44	
Asbestos or occupational exposure		
No	493	74
Yes	128	19
ILD present on baseline LDCT		
No	617	93
Yes	45	7
Emphysema present on baseline LDCT		
None	97	15
Trivial <5%	205	31
Mild 5-25%	208	31
Moderate 25-50%	73	11
Severe 50-75%	56	8
Very severe >75%	9	1

Results summary

	Frequency (n)	Percentage (%)
Overall outcome		
Cancer	408	62%
Benign	254	38%
Cancer type		
Lung cancer	398	60%
Non-lung cancer	10	2%
Histology		
Adenocarcinoma	257	68
Squamous cell carcinoma	81	21
Small cell carcinoma	18	5
Large cell carcinoma	8	2
Adenosquamous carcinoma	5	1
Carcinoid	4	1
Other	6	2

	Counts	Percentages
Lung cancer stage		
IA	117	62
IB	25	13
IIA	3	2
IIB	14	7
IIIA	22	12
IIIB	5	3
IV	1	1
other	2	1

Results of PET-CT evaluation according to nodule characteristics and screening round

	PET-CT	Sens	Spec	PPV	NPV	Accuracy	p value
Overall	662	0.72	0.48	0.69	0.52	0.63	
Nodule diameter							0.2202
≤30mm	622	0.7	0.48	0.68	0.51	0.61	
○ ≤10mm	112	0.51	0.55	0.75	0.3	0.52	
○ >10 ≤20mm	383	0.7	0.51	0.64	0.58	0.62	
○ >20 ≤30mm	127	0.87	0.35	0.72	0.58	0.69	
>30 ≤50mm	39	1	0.5	0.85	1	0.87	
Nodule type							0.1991
Solid	520	0.78	0.46	0.66	0.6	0.64	
Part solid	109	0.52	0.74	0.88	0.29	0.57	
GGO	15	0.75	0.67	0.9	0.4	0.73	
Screening round							0.1991
Baseline	417	0.77	0.5	0.7	0.58	0.66	
Year 1	124	0.59	0.47	0.75	0.3	0.56	
Year 2	121	0.73	0.45	0.62	0.58	0.6	

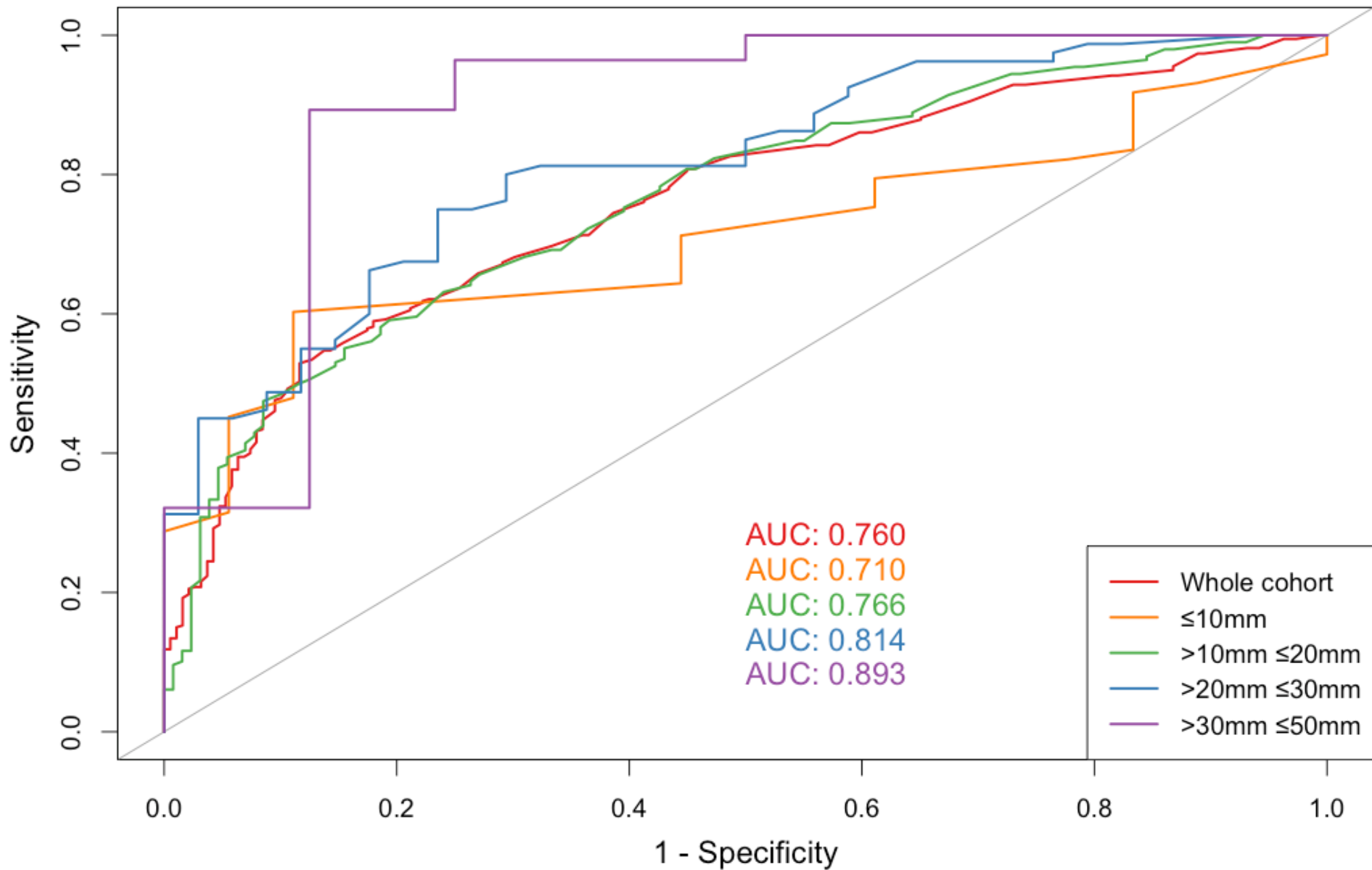
Positivity threshold: nodule SUV_{max} ≥2.5 or nodule characterised as moderate or intense on BTS ordinal scale
 Reference standard: histology or stability on surveillance imaging >24 months

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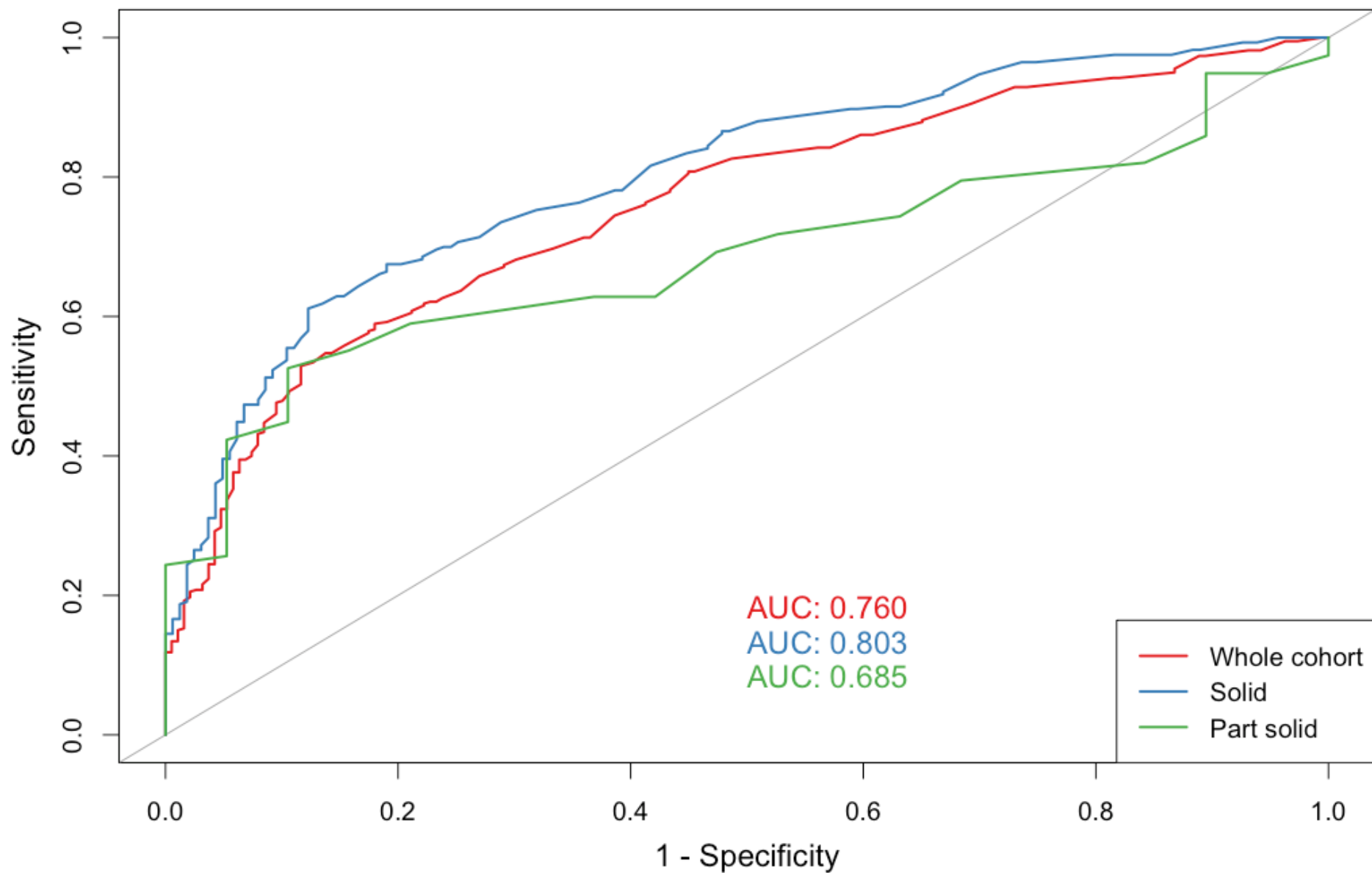
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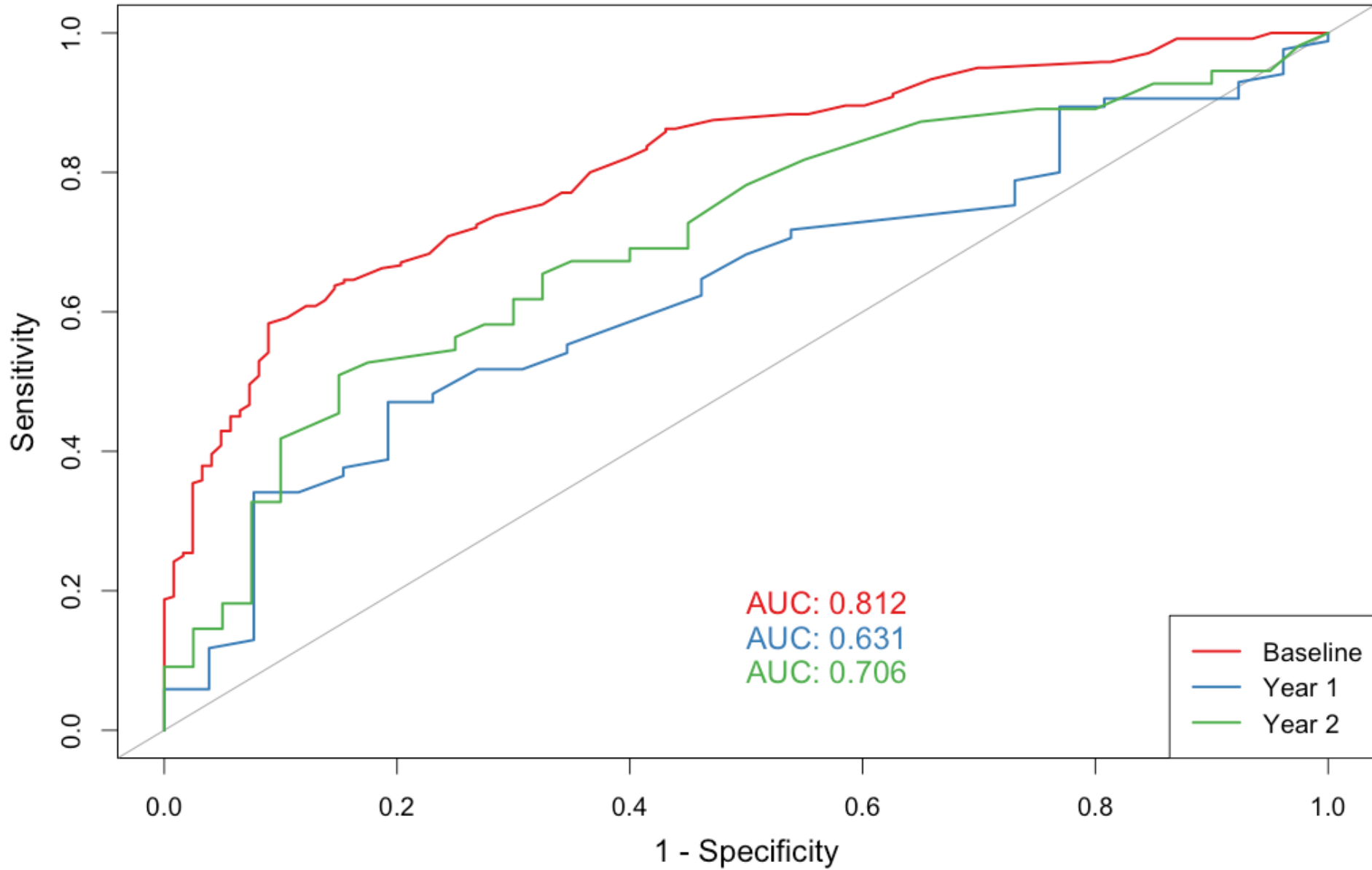
ROC Curves by Nodule Size in SUMMIT



ROC Curves by Nodule Type in SUMMIT



ROC Curves by Screening Round in SUMMIT



Conclusions

- Current evidence base for use of PET-CT in screen detected nodules is limited
- We demonstrate that PET-CT has sub-optimal sensitivity, specificity and NPV in discriminating malignant from benign nodules in a screening cohort.
- Performance is inferior for sub-centimetre nodules, non-solid nodules, and nodules detected at prevalence screening rounds
- The limitations of PET in detecting small and low-grade tumours are amplified in a screening population
- Further work is ongoing to determine the role of PET-CT in evaluating screen detected nodules in UK screening cohorts

- Thank you!
- Any questions?