Blood test trends for cancer detection in patients presenting with unexpected weight loss in primary care: a diagnostic accuracy, longitudinal cohort study

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CANCER RESEARCH UK

UNIVERSITY OF OXFORD

BLOTTED — BLOod Test Trend for cancEr Detection

NUFFIELD DEPARTMENT OF PRIMARY CARE HEALTH SCIENCES
Medical Sciences Division

Blood test abnormalities facilitate referral

- Lung –↑ platelets
- Oesophageal – ↑ platelets
- Colorectal – iron-deficiency anaemia
- Endometrial – ↑ platelets
- Bladder – ↑ WBC
- Myeloma – ↑ calcium/ESR/ PV

Unexpected weight loss (UWL) is a cancer feature

RESEARCH ARTICLE

Combining simple blood tests to identify primary care patients with unexpected weight loss for cancer investigation: Clinical risk score development, internal validation, and net benefit analysis

Brian D. Nicholson[1]*, Paul Aveyard[1], Constantinos Koshiaris[1], Rafael Perera[1], Willie Hamilton[2], Jason Oke[1], F. D. Richard Hobbs[1]

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Blood test abnormalities:

1. Low albumin
2. Raised ALP
3. Raised AST
4. Raised ALT
5. Raised bilirubin
6. Raised CRP
7. Raised ESR
8. Raised WBC
9. Raised platelets
10. Low haemoglobin
11. Low MCV
12. Raised monocytes
13. Raised neutrophils
14. Low lymphocytes

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Blood test trend may help

cancers

MDPI

Systematic Review

The Association between Blood Test Trends and Undiagnosed Cancer: A Systematic Review and Critical Appraisal

Pradeep S. Virdee [1,*], Kiana K. Collins [1], Claire Friedemann Smith [1], Xin Yang [2], Sufen Zhu [1], Sophie E. Roberts [3], Nia Roberts [4], Jason L. Oke [1], Clare Bankhead [1], Rafael Perera [1], FD Richard Hobbs [1] and Brian D. Nicholson [1]

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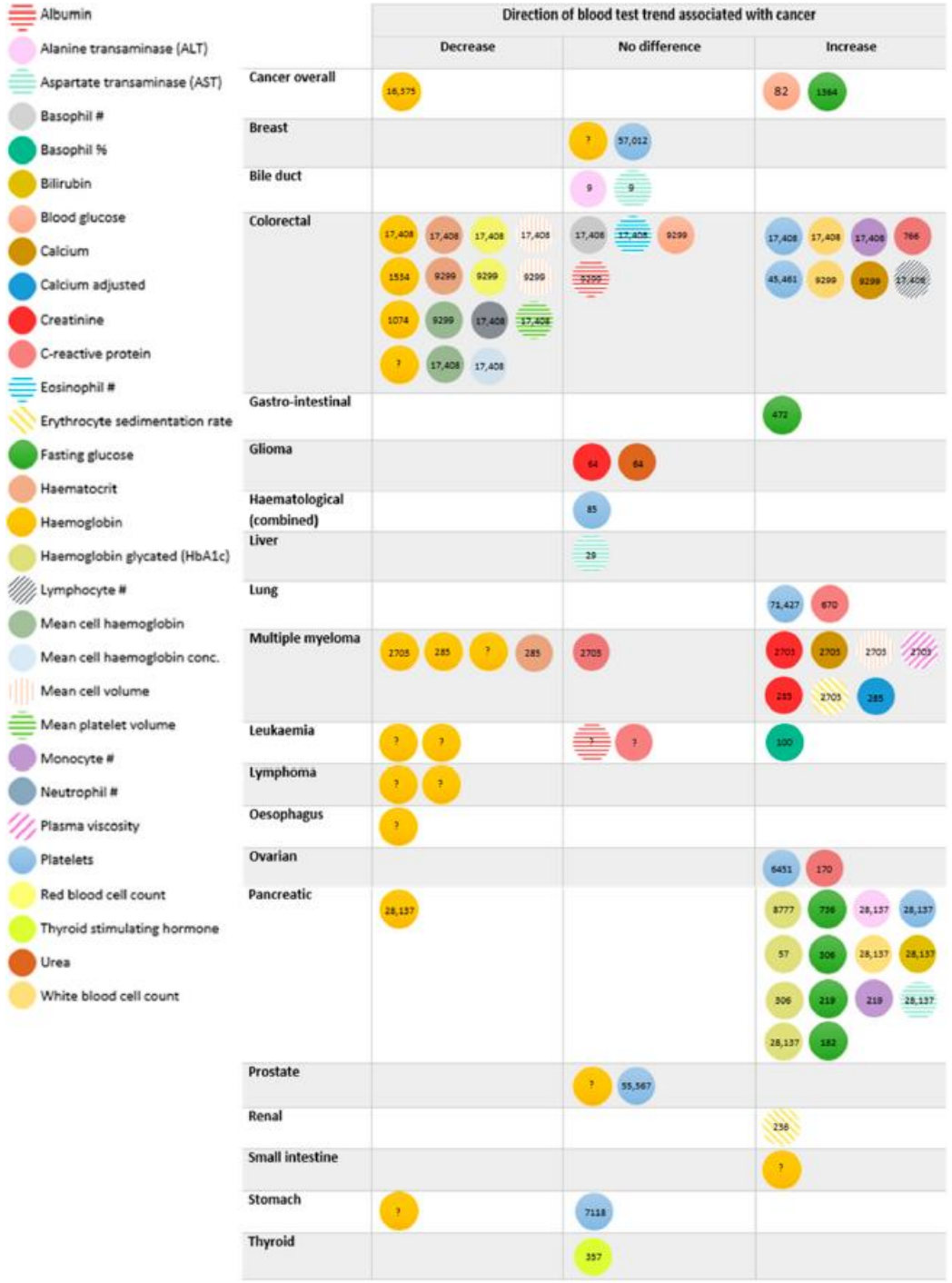


Aim:

To compare the diagnostic accuracy of blood test trend to blood test abnormality in primary care patients with UWL

Data source

Clinical practice research datalink Aurum
Personal characteristics
Signs and symptoms
Blood tests
Co-morbidity
Prescribed medications
Other primary care investigations
Screening participation and findings
Index of multiple deprivation

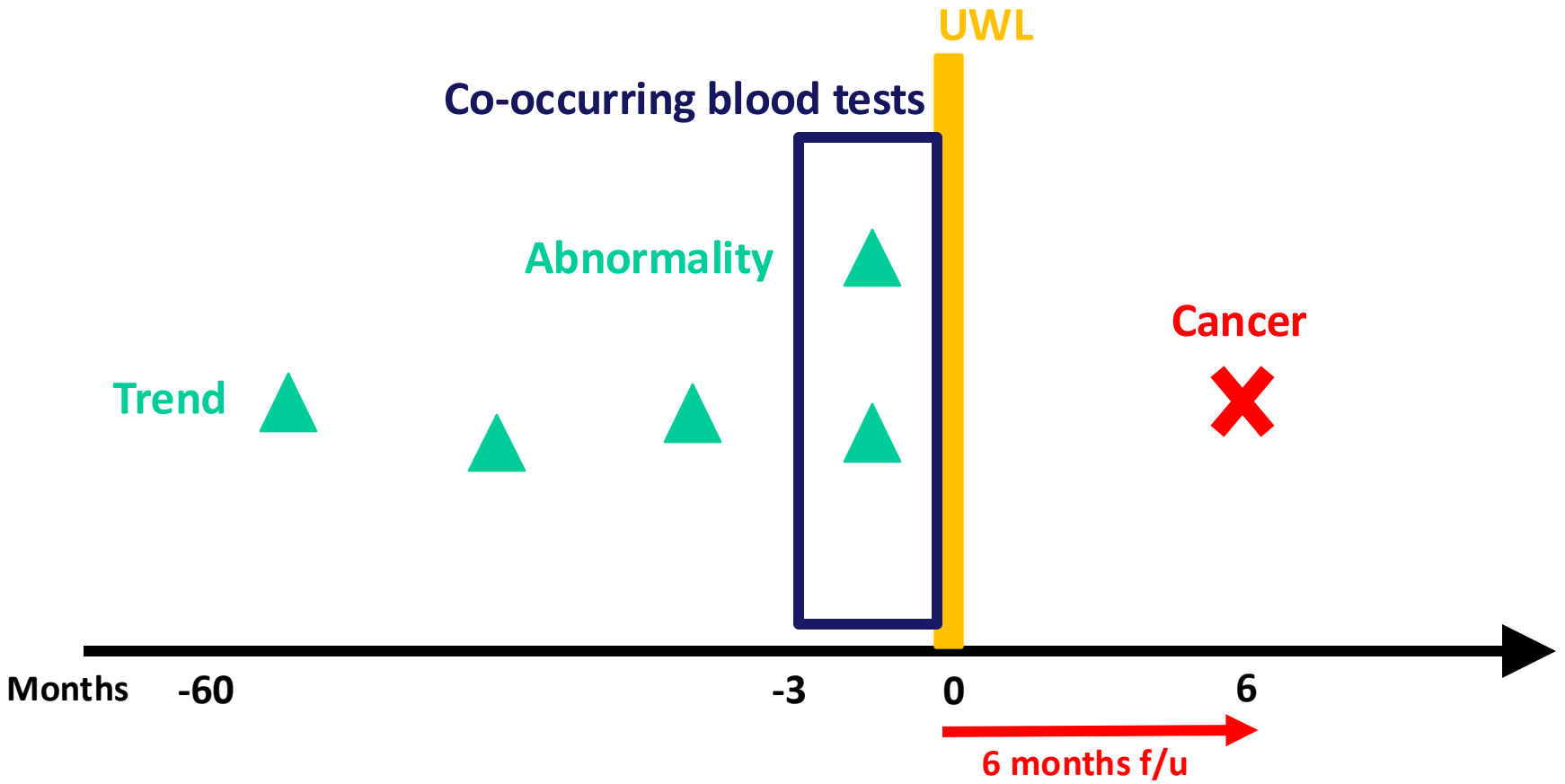
National Cancer Registration and Analysis Service
Cancer diagnosis
Cancer characteristics

Hospital Episode Statistics
Cancer diagnosis
Death

Death registration
Cancer diagnosis
Death

~28 million English patients
20 years of data
2000-2019

Study details



Inclusion:
First UWL diagnosis
Age 18+ years at UWL
Eligible for linkage

Exclusion:
Weight-reducing medication/bariatric surgery within 6 months pre-UWL
Cancer diagnosis pre-UWL

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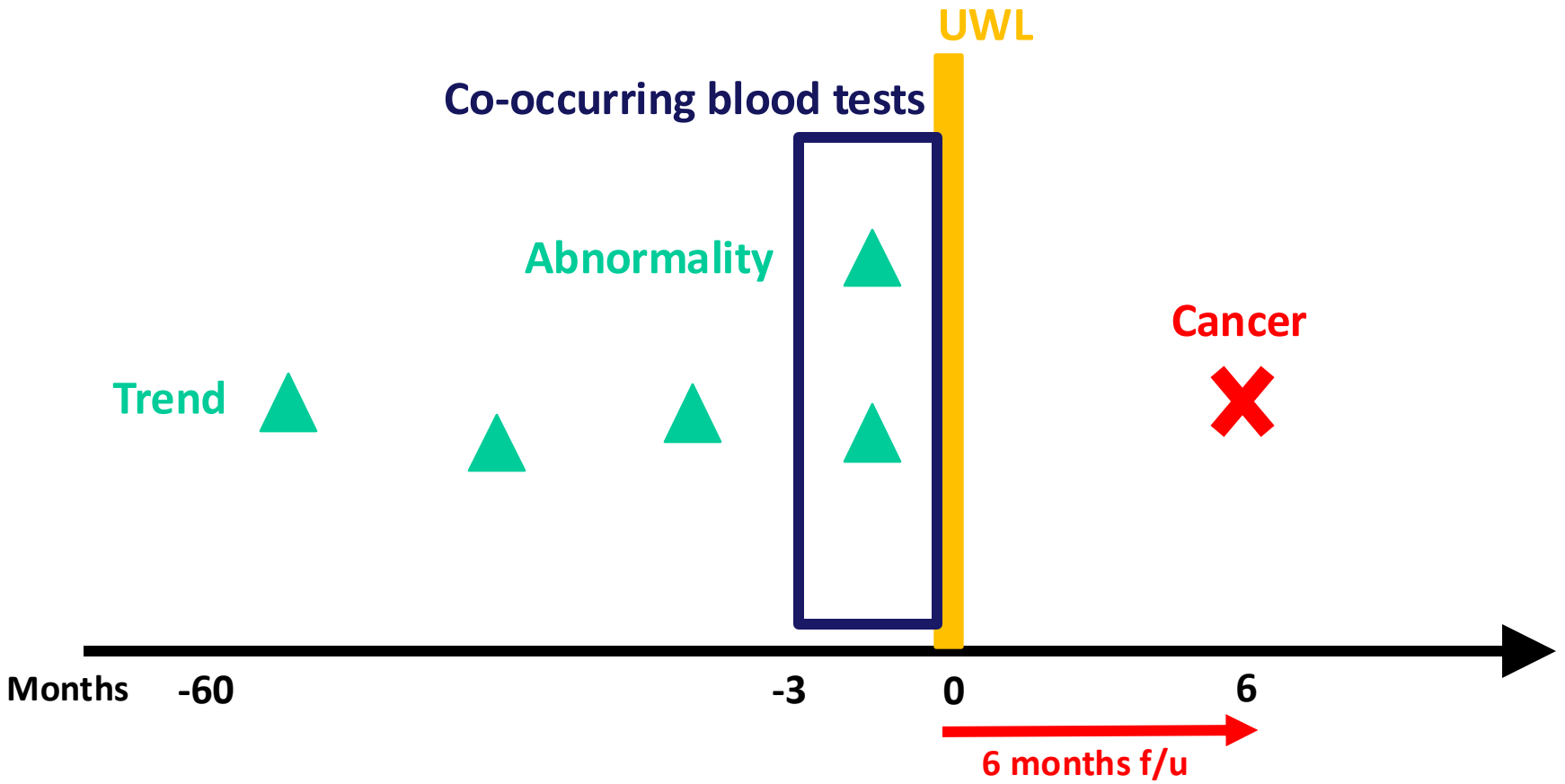

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Analytic methods

Abnormality	Trend
Defined using reference ranges (e.g. albumin <35g/L)	Defined as change over time in a patient's blood test results
Cox models	Joint models

Area under the curve (AUC)
Positive predictive value (PPV)
Negative predictive value (NPV)

Summary of patient data

Patient data	N (%)
% (Cancer/Total)	5% (13,781/274,817)
Sex	
Female	159,368 (58.0%)
Male	115,449 (42.0%)
Age (years)	
18-39	46,927 (17.1%)
40-49	30,263 (11.0%)
50-59	36,713 (13.4%)
60-69	42,474 (15.5%)
70-79	56,566 (20.6%)
80+	61,874 (22.5%)

Blood test	N (%) with a test	Mean (SD) no. tests per patient
Albumin (g/L)	236,931 (86.2%)	4.8 (6.9)
ALP (iu/L)	247,985 (90.2%)	5.1 (7.1)
ALT/AST (iu/L)	246,561 (89.7%)	4.9 (7.0)
Bilirubin (umol/L)	247,113 (89.9%)	4.9 (7.0)
Haemoglobin (g/dL)	263,990 (96.1%)	5.6 (7.7)
Lymphocyte count (10^9/L)	255,364 (92.9%)	5.3 (7.4)
MCV (fL)	260,227 (94.7%)	5.4 (7.6)
Monocyte count (10^9/L)	254,665 (92.7%)	5.2 (7.4)
Neutrophil count (10^9/L)	255,295 (92.9%)	5.3 (7.5)
Platelets (10^9/L)	261,893 (95.3%)	5.5 (7.6)
WBC (10^9/L)	262,146 (95.4%)	5.5 (7.6)
CRP (mg/L)	119,630 (43.5%)	1.2 (4.0)
ESR (mm/h)	156,485 (56.9%)	1.8 (5.1)

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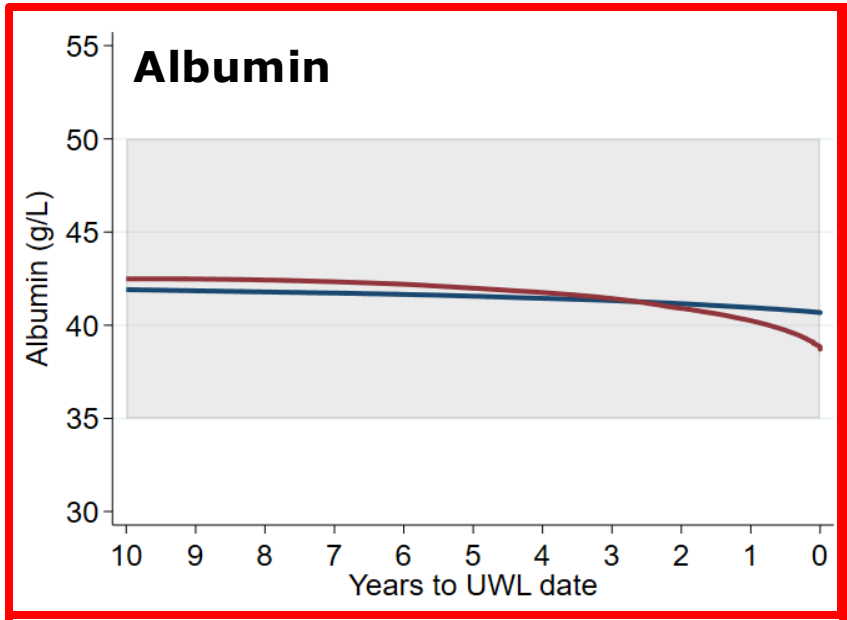
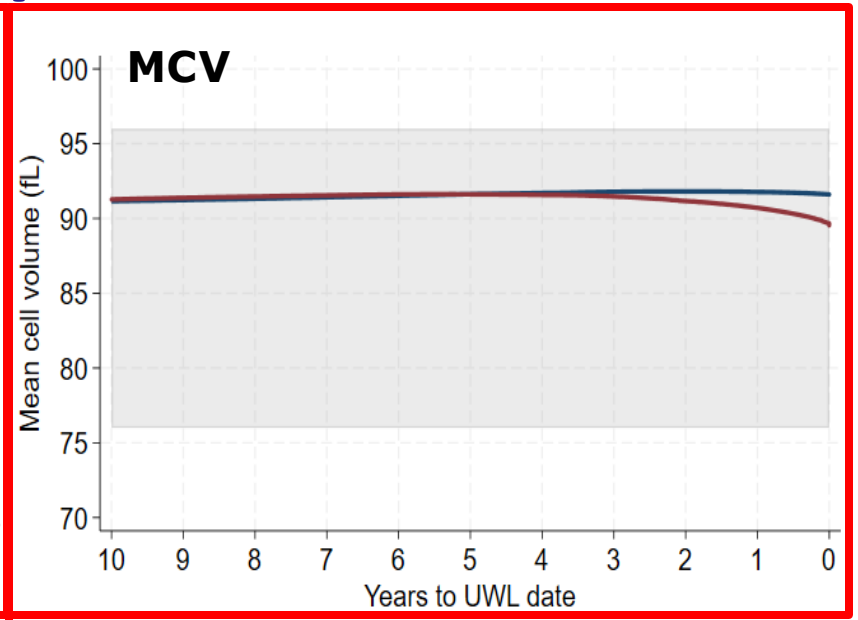
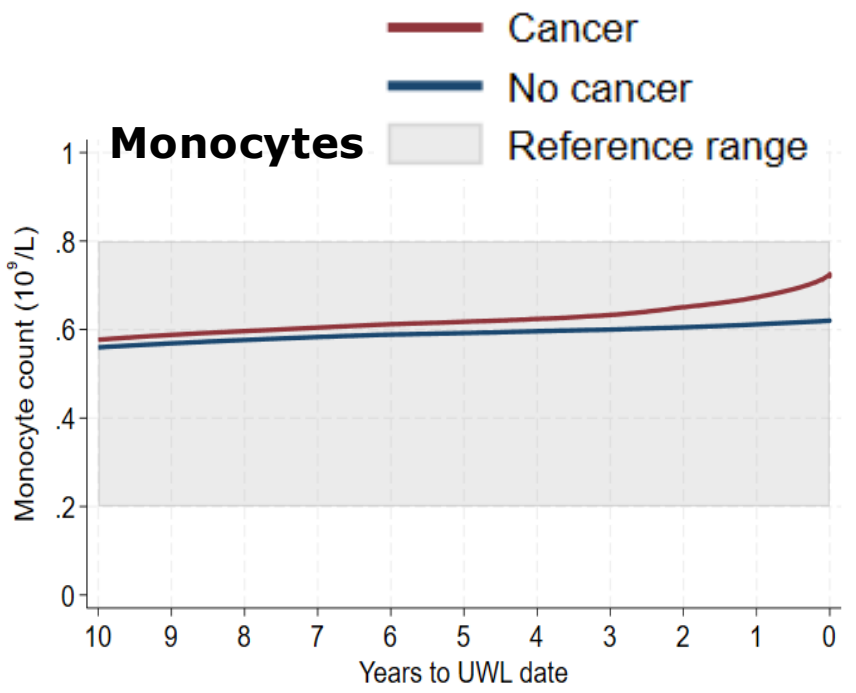
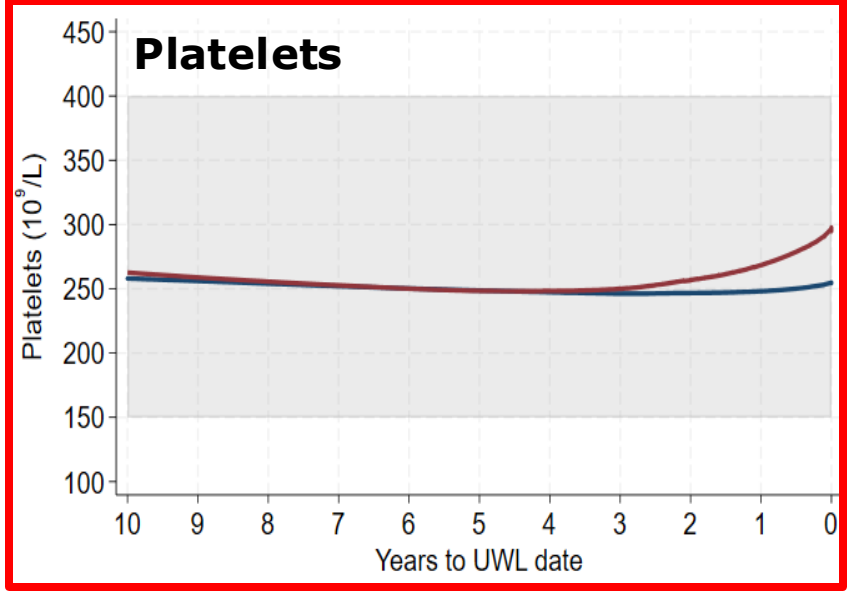
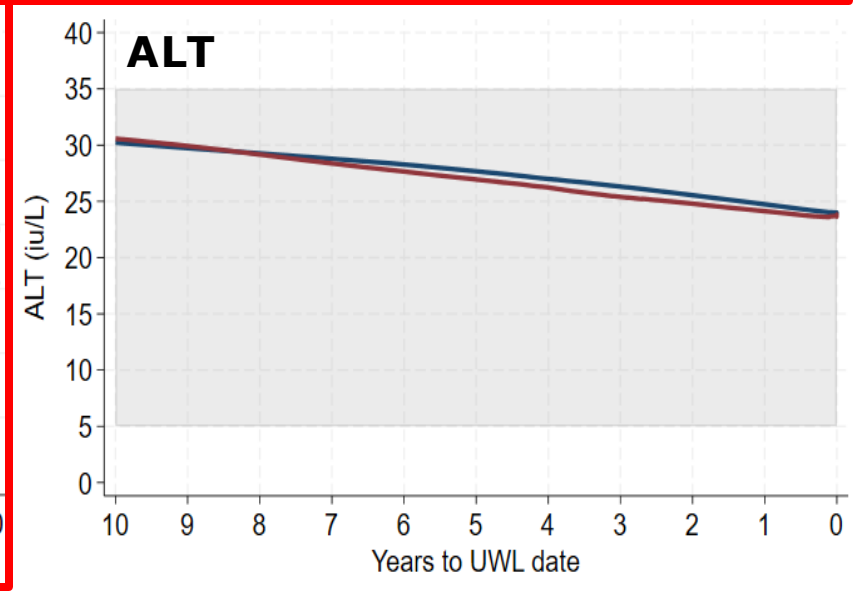
Blood test trend in patients with UWL

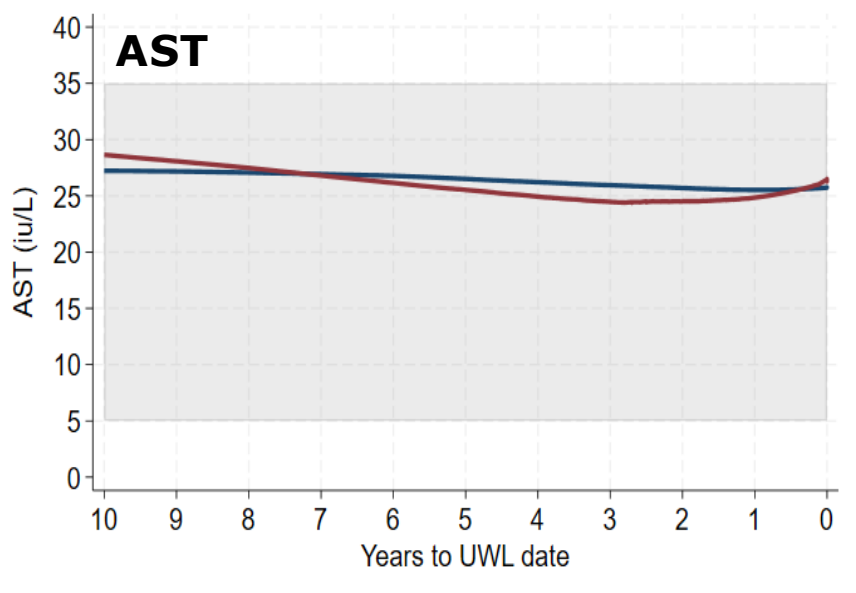












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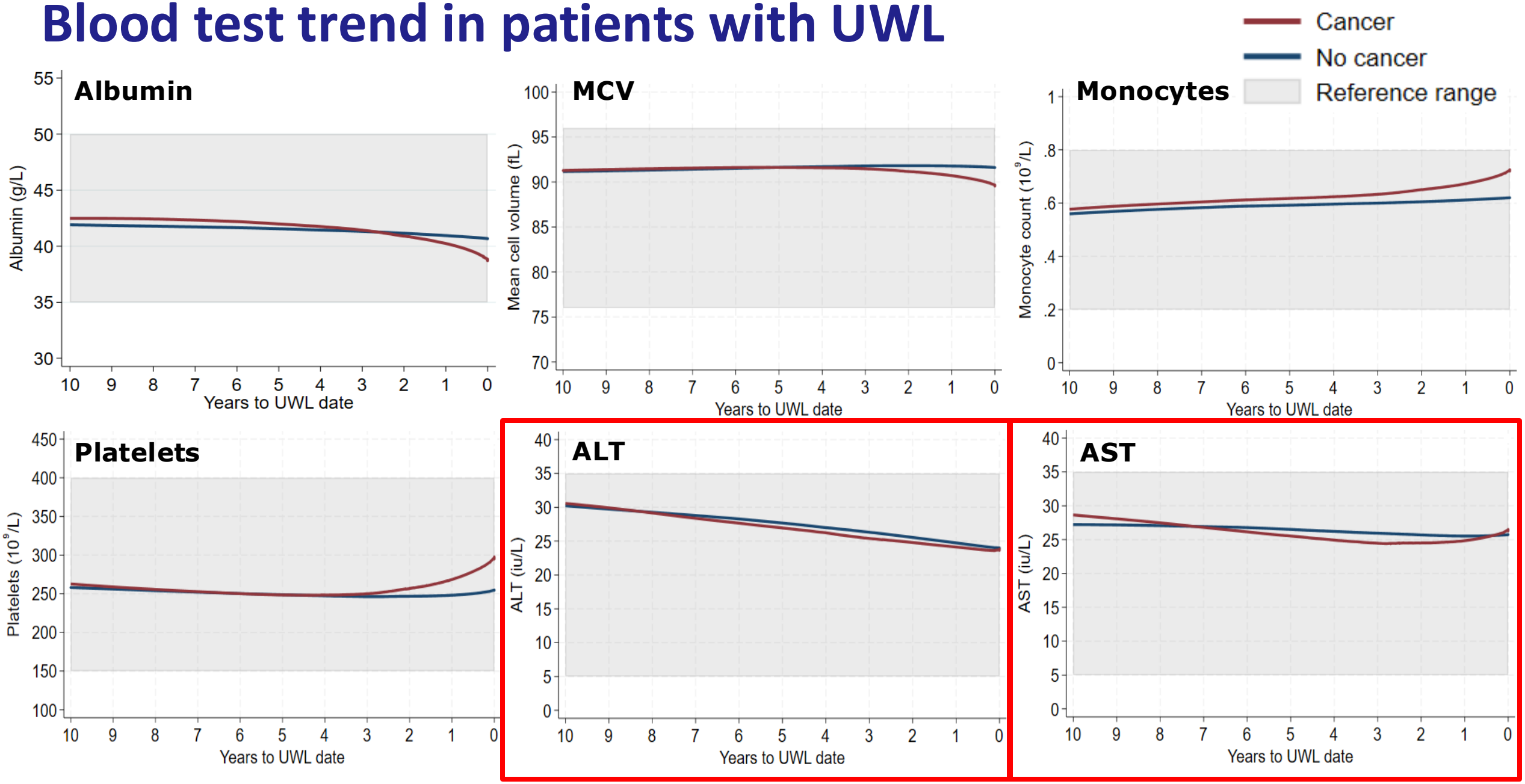

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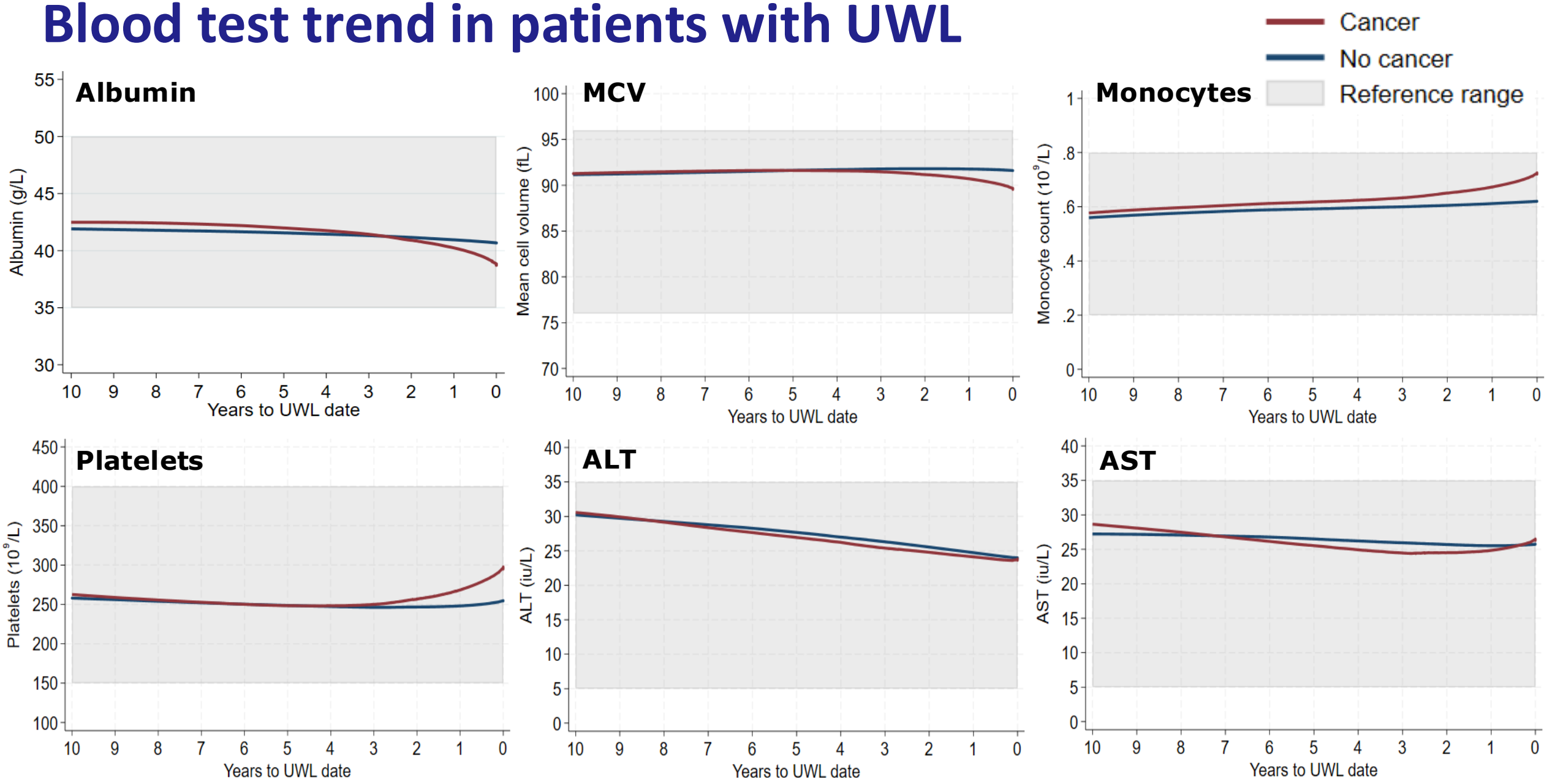
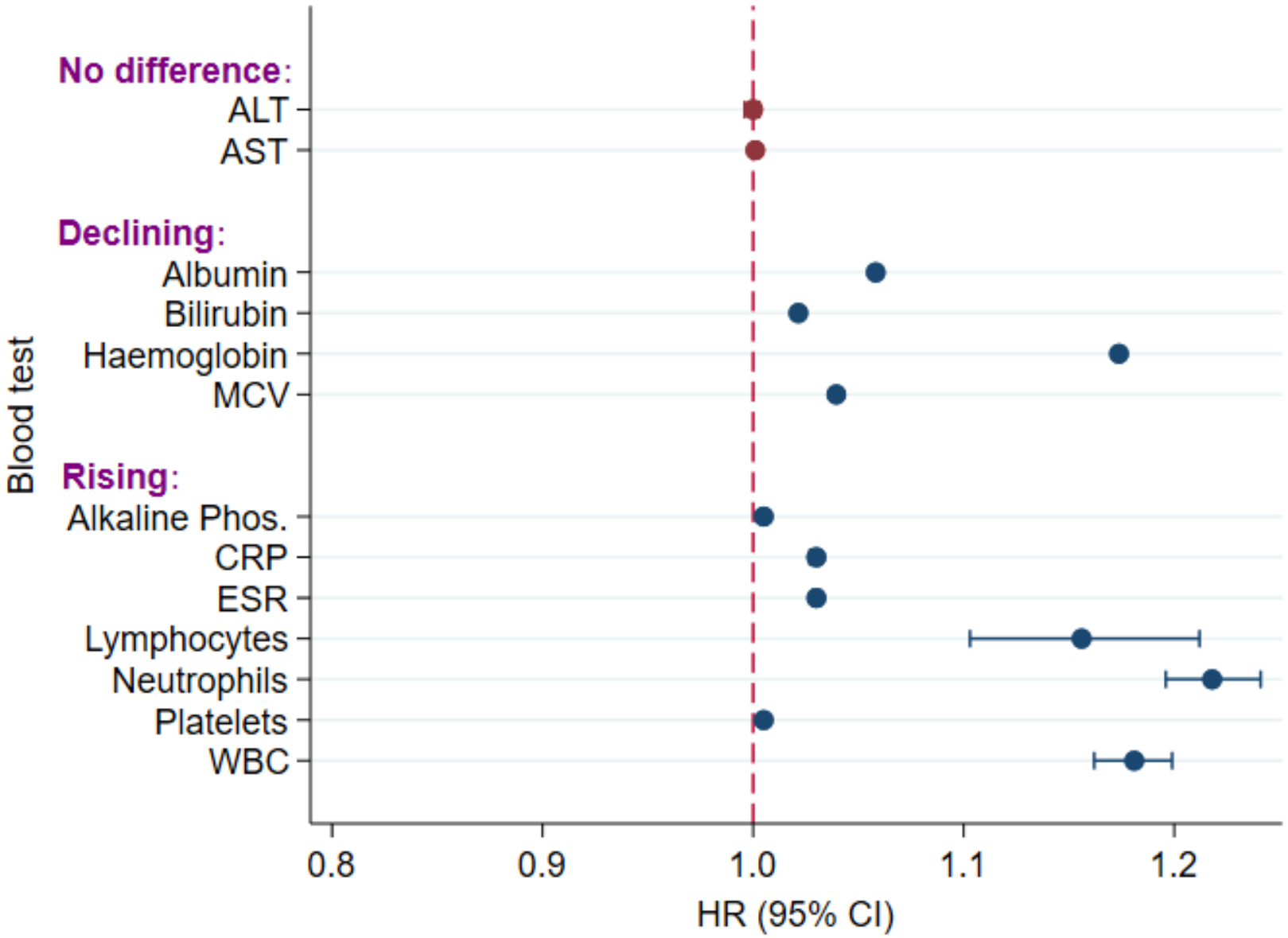
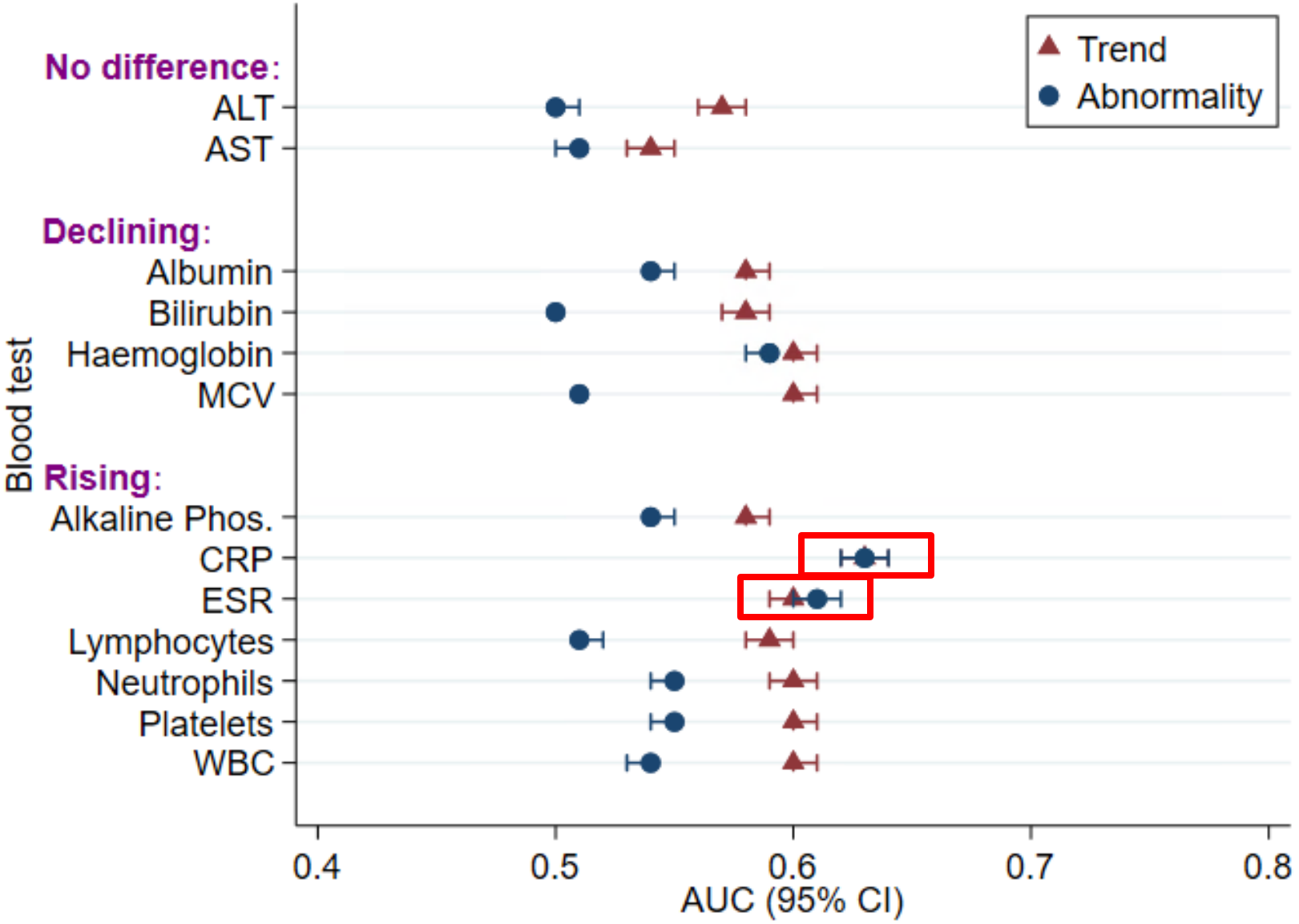


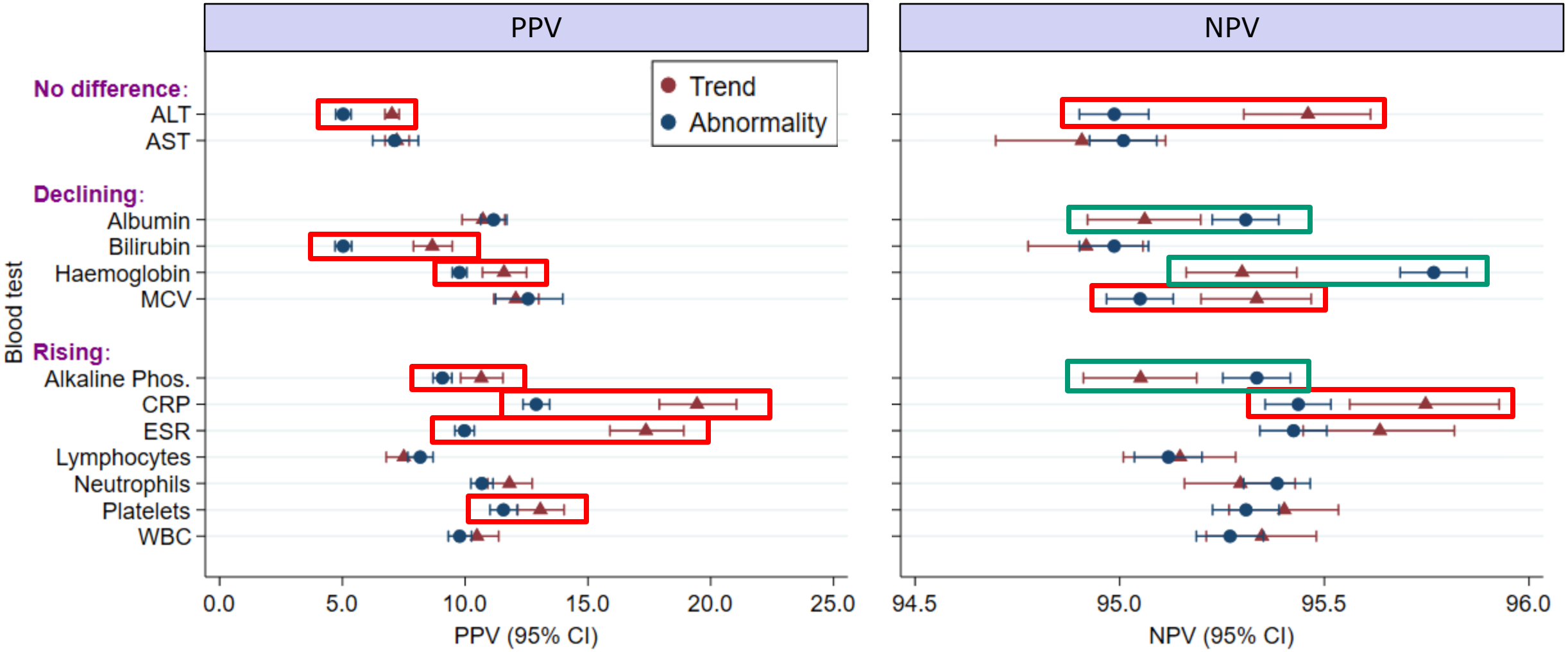
Hazard ratios for trend



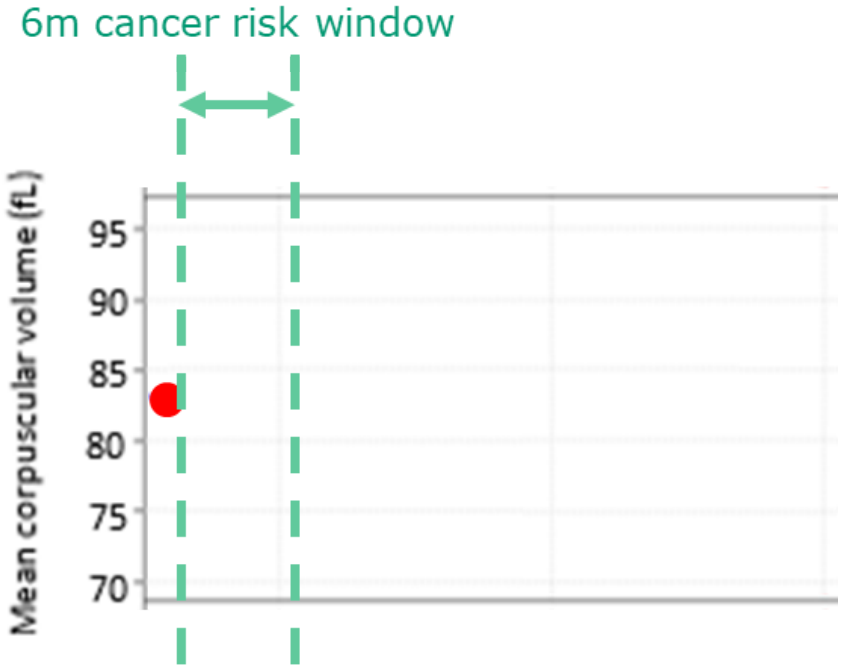
AUC for trend and abnormality



PPV and NPV for trend and abnormality



Real example (female, aged 60 years)



Risk

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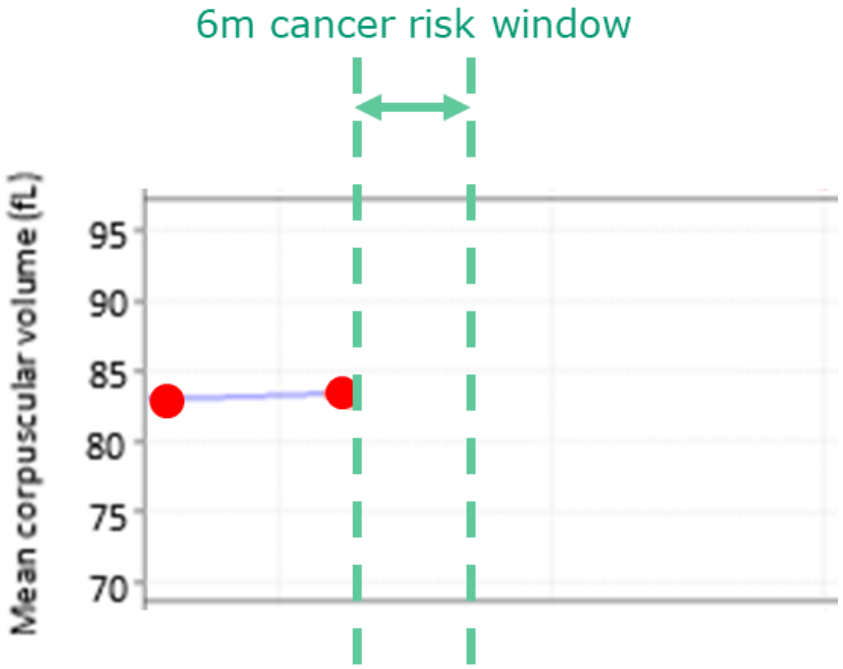

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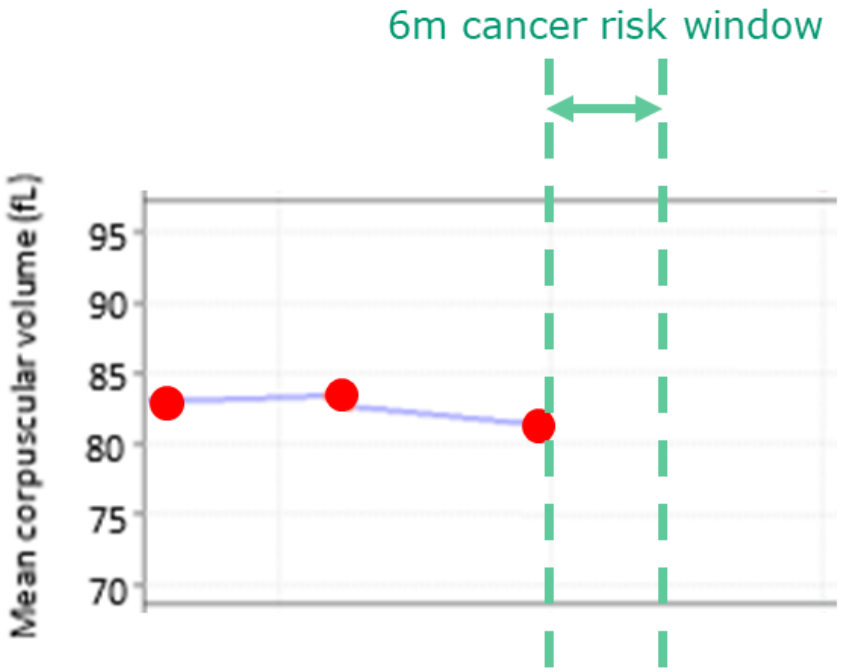

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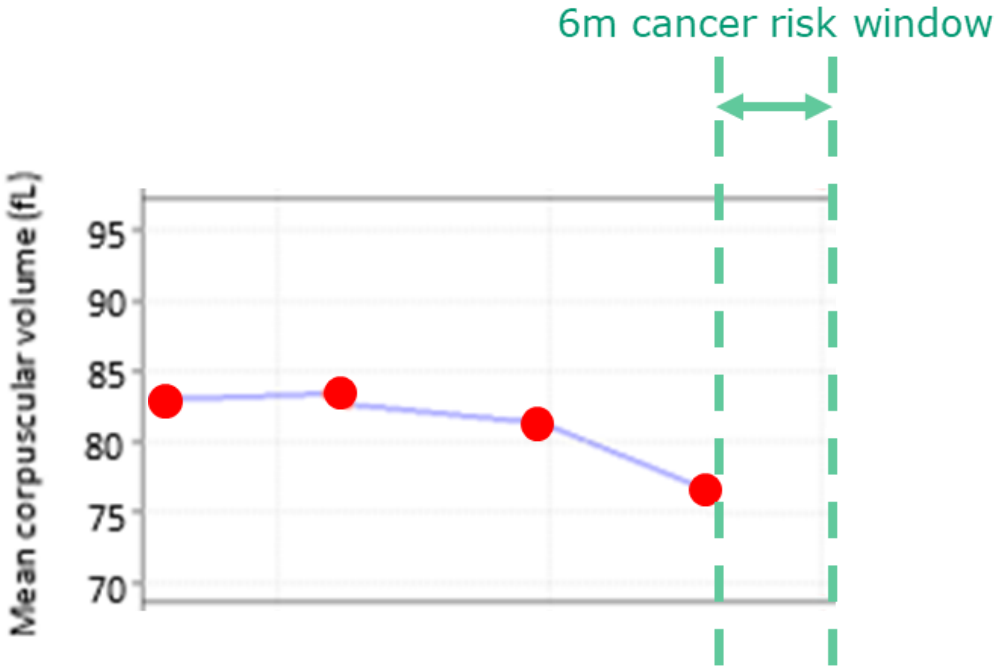

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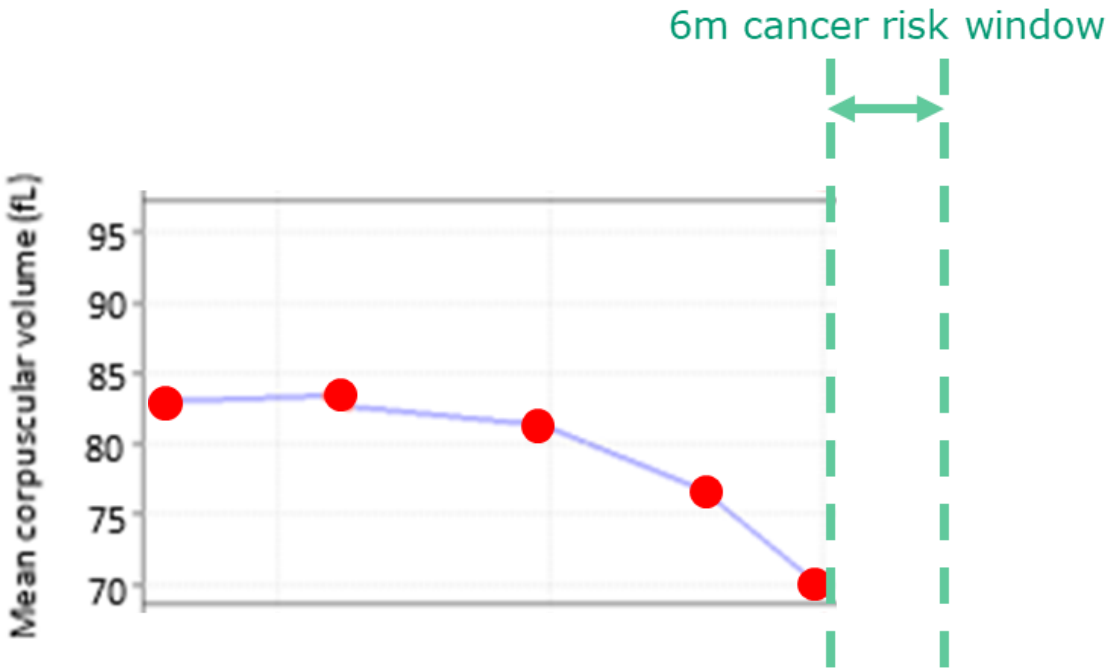
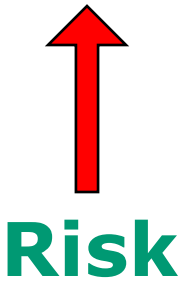


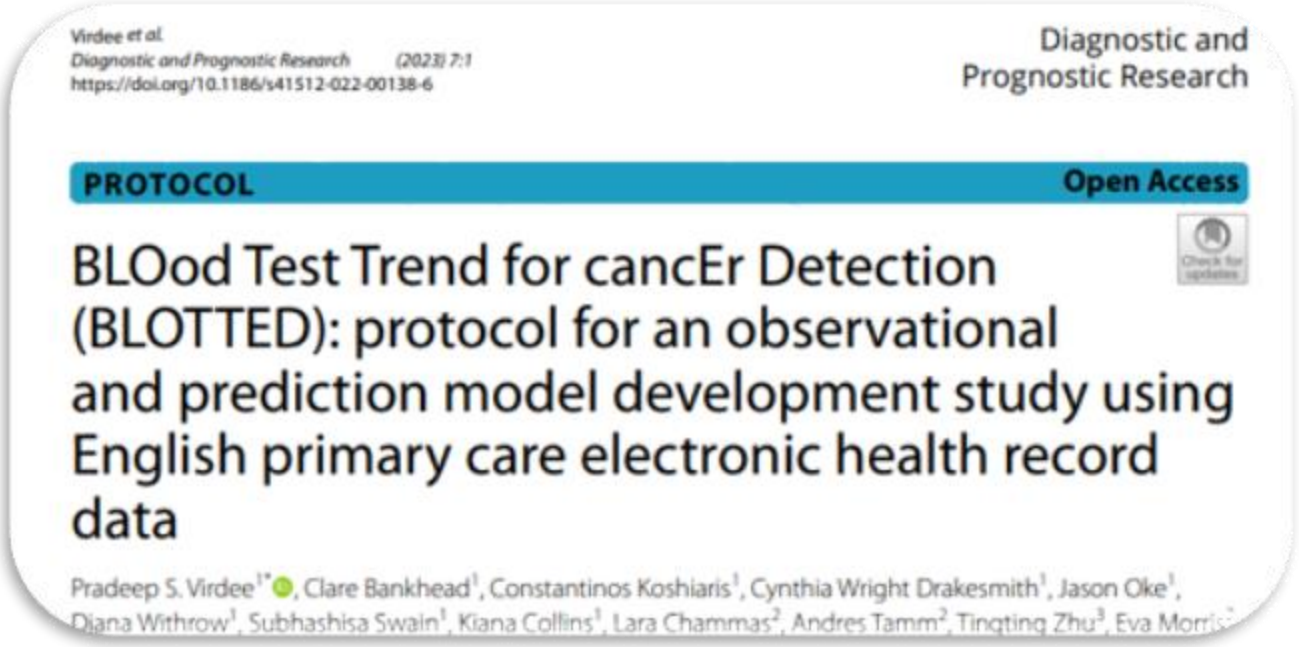


Risk

Conclusion

Trend in many blood tests associated with cancer diagnosis in UWL patients
Trend often has better diagnostic accuracy than abnormality

Next steps:
Adjust for important features, e.g. age and sex
Explore trend in other non-specific symptom cohorts
Risk prediction model incorporating trend, symptoms, and further patient data



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