ISTH 2025 CONGRESS JUNE 21-25
WASHINGTON, D.C.
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Untangling profiles of post-thrombotic syndrome using unsupervised machine learning

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Iding AFJ et al, Blood Advances, 2025 (in press)

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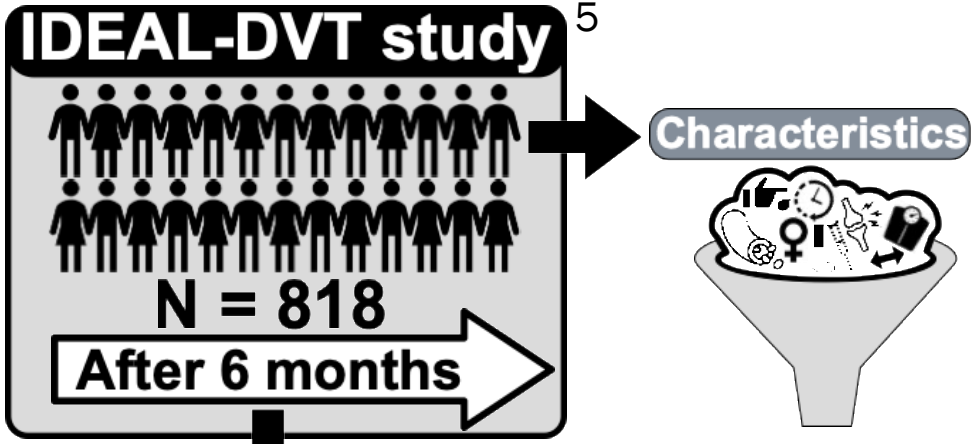
Disclosure belangen spreker – Aaron Iding	
Nederlands Trombose Congres – 16 mei 2025	
(potentiële) Belangenverstrengeling	
Voor bijeenkomst mogelijk relevante relaties met bedrijven	Invullen, als er geen disclosure is, dan vermelden: **Geen**
• Sponsoring of onderzoeksgeld • Honorarium of andere (financiële) vergoeding • Aandeelhouder • Andere relatie, namelijk:	Invullen, als er geen disclosure is, dan vermelden: **Geen**

Background

- **Post-thrombotic syndrome (PTS)** is a chronic venous disease that develops in 20–50% of patients after deep vein thrombosis (DVT) [1]
- It is defined as a **Villalta score** ≥ 5 based on ISTH consensus [1]
- Villalta score consists of 11 signs and symptoms, each scored from 0 (none) to 3 (severe), and presence of venous ulcer, which is rare
- Studies suggest patients with DVT form a ***heterogeneous population*** [2-4]
- However, research on whether PTS itself represents a ***heterogeneous syndrome*** remains limited, despite its multifactorial pathophysiology

1. Kahn SR et al, JTH, 2009; 2. Iding AFJ et al, JTH, 2023;
3. de Winter MA, JTH, 2023; 4. Pallares Robles A, Thromb Res, 2023

Methods



[5]

Hierarchical clustering of patients into

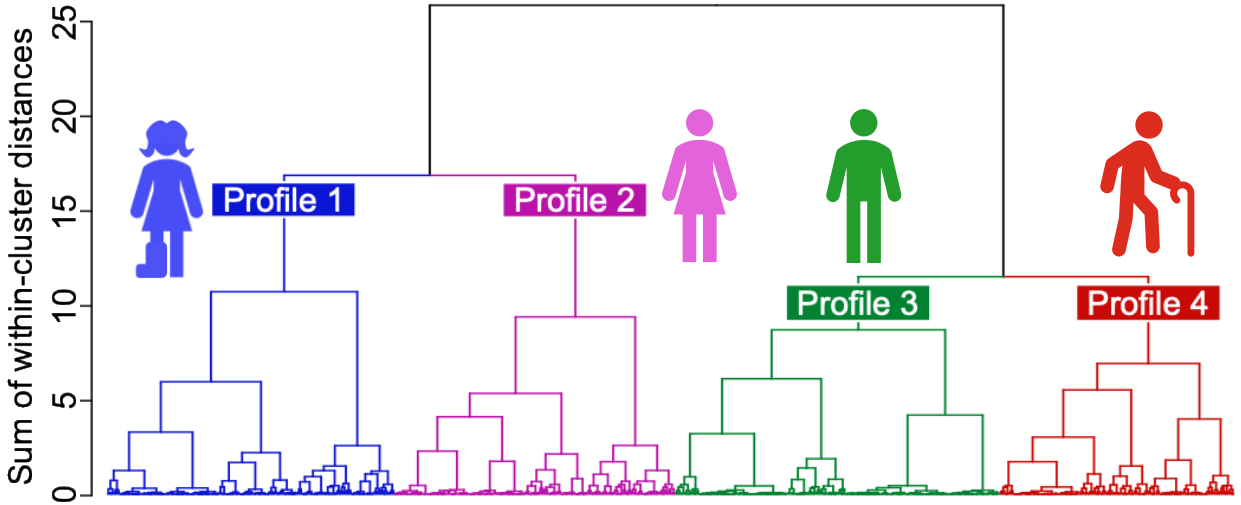
Clinical profiles

Variable clustering of items into

Dimensions of PTS

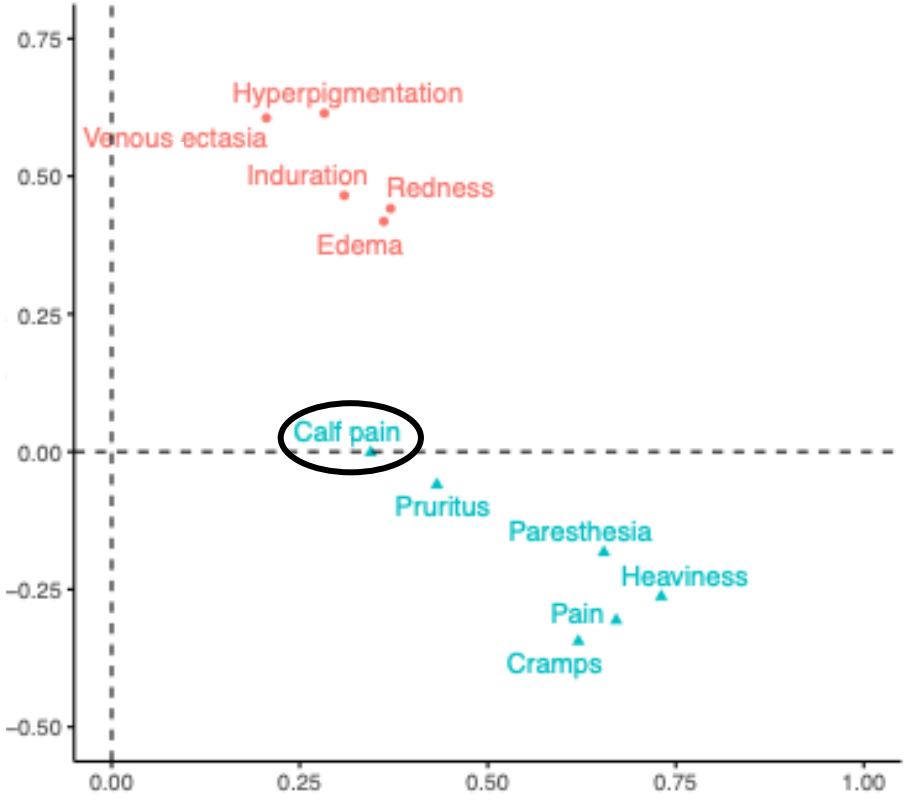
5. ten Cate-Hoek et al, Lancet Haematol, 2018

Clinical profiles



Six months	Profile 1	Profile 2	Profile 3	Profile 4
Total score	3.7	3.6	3.4	3.5
PTS (≥ 5)	31.9%	29.2%	27.2%	27.6%
MS-PTS (≥ 10)	5.9%	5.7%	5.1%	4.7%

Dimensions of PTS



Sign score

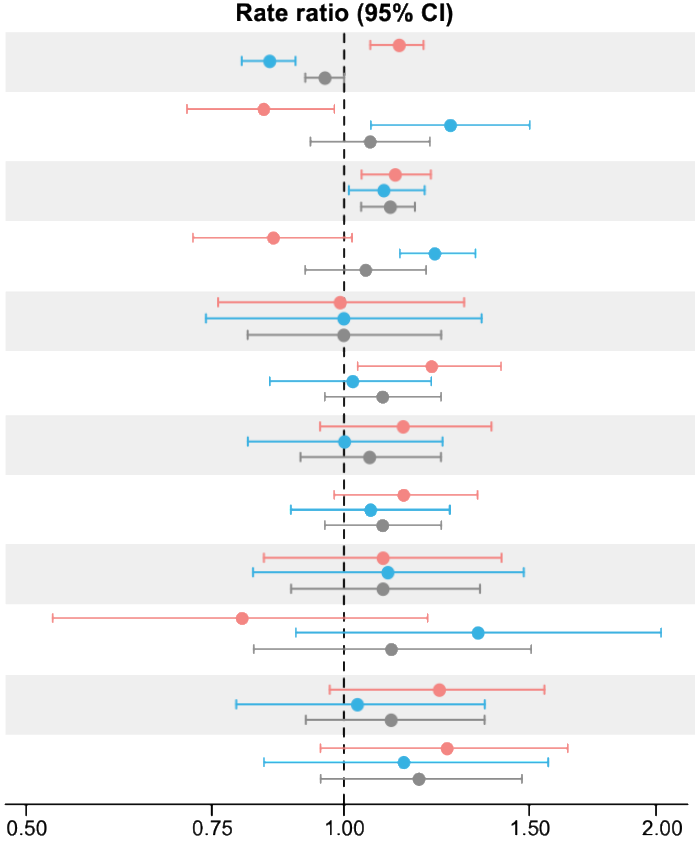
≥ 5 in **6%**

≥ 5 in **14%**

Symptom score

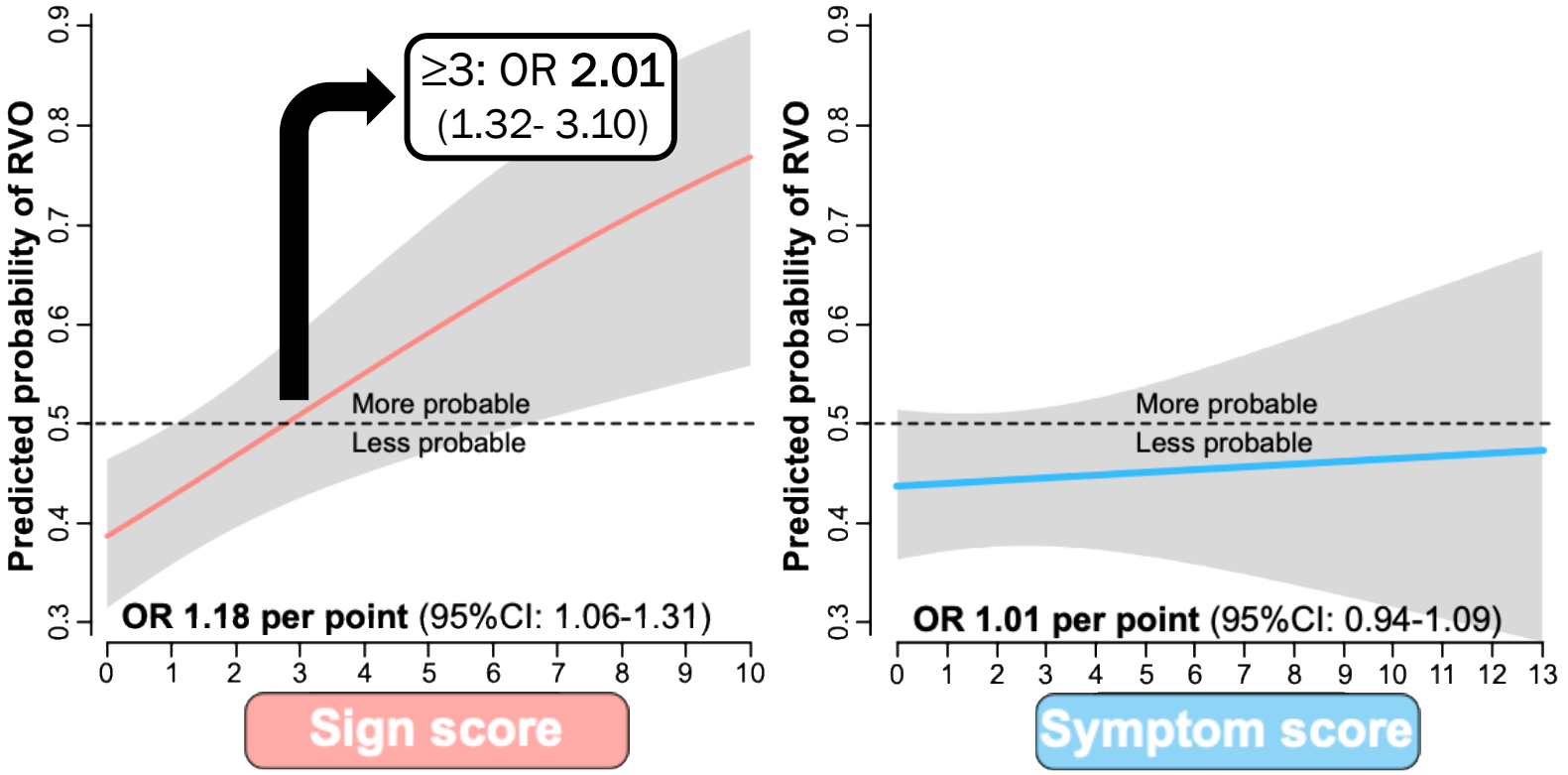
r = 0.19

Clinical characteristics



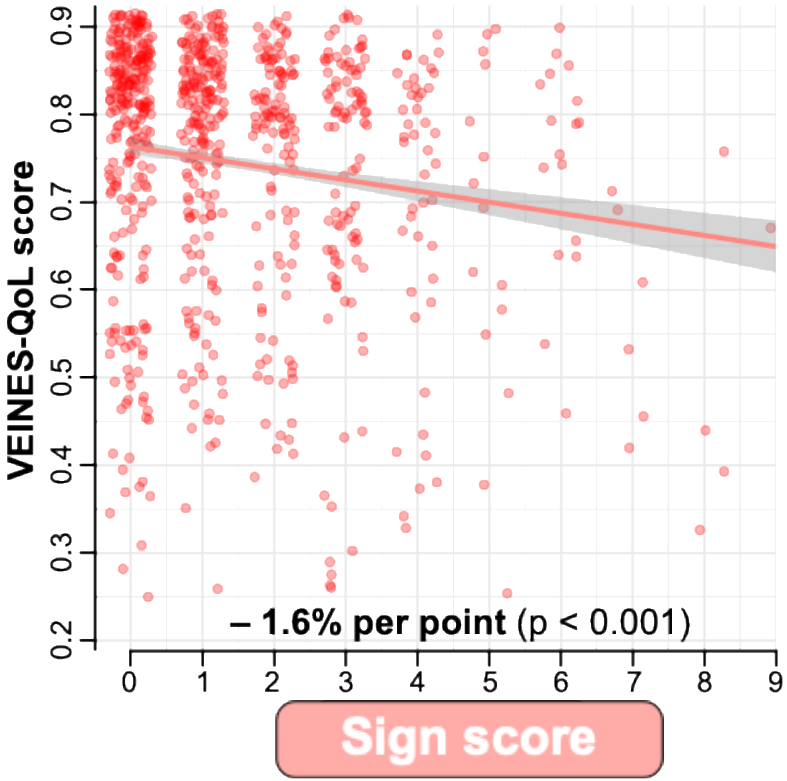
Characteristic	Sign score	Symptom score	Total score
Age (per 10 years)	**1.13 (1.06-1.19)**	**0.85 (0.80-0.90)**	0.96 (0.92-1.00)
Female sex	**0.84 (0.71-0.98)**	**1.26 (1.06-1.50)**	1.06 (0.93-1.21)
BMI (per 5 kg/m^2)	**1.12 (1.04-1.21)**	**1.09 (1.01-1.19)**	**1.11 (1.04-1.17)**
Provoked DVT	0.85 (0.72-1.02)	**1.22 (1.01-1.47)**	1.05 (0.92-1.20)
Popliteal vein	0.99 (0.76-1.30)	1.00 (0.74-1.35)	1.00 (0.81-1.24)
Femoral vein	**1.21 (1.03-1.41)**	1.02 (0.85-1.21)	1.09 (0.96-1.24)
Common femoral vein	1.14 (0.94-1.38)	1.00 (0.81-1.24)	1.06 (0.91-1.24)
Left-sided DVT	1.14 (0.98-1.34)	1.06 (0.89-1.26)	1.09 (0.96-1.24)
Previous contra-lateral DVT	1.09 (0.84-1.41)	1.10 (0.82-1.48)	1.09 (0.89-1.35)
Chronic inflammatory disease	0.80 (0.53-1.20)	1.34 (0.90-2.06)	1.11 (0.82-1.51)
Joint pain	1.23 (0.97-1.55)	1.03 (0.79-1.36)	1.11 (0.92-1.36)
Diabetes	1.25 (0.95-1.63)	1.14 (0.84-1.56)	1.18 (0.95-1.48)

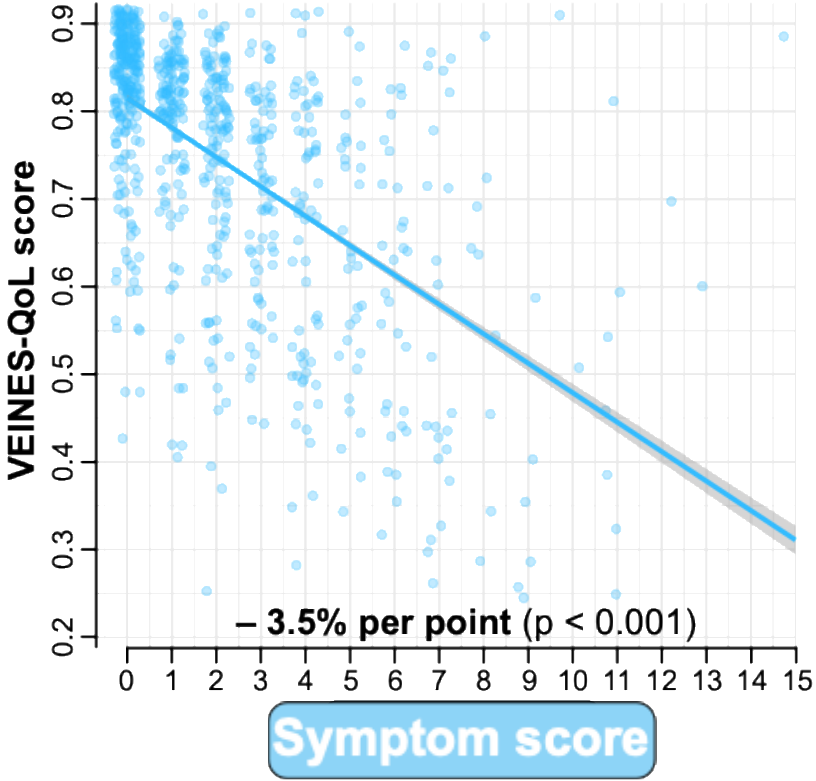
Residual venous obstruction [6]



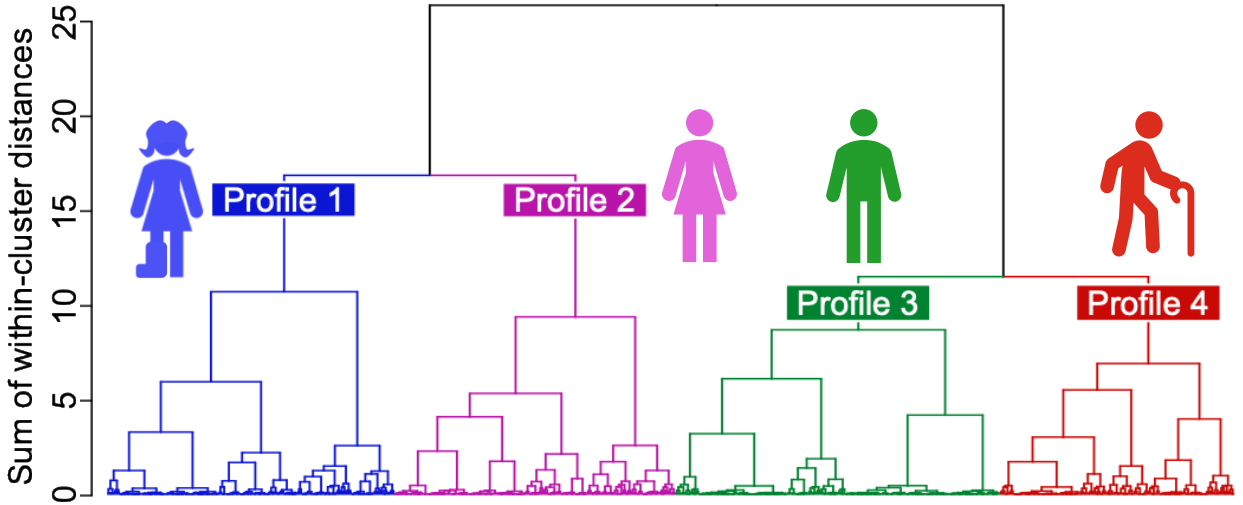
6. Amin EE et al, Blood, 2018

Quality of life





Revisiting profiles



Six months

	Profile 1	Profile 2	Profile 3	Profile 4
Sign score	1.3[d]	1.5	1.4[d]	1.9[a,c]
≥ 3	18.1%[d]	24.4%	20.9%[d]	34.1%[a,c]
Symptom score	2.4[d]	2.1	2.0	1.6[a]
≥ 3	40.7%[d]	32.1%	30.6%	20.6%[a]

Conclusions

- Sign and symptom scores represent distinct dimensions of PTS
- These scores relate differently to clinical profiles and outcomes
- Using the total Villalta score may obscure risk-stratification [7-9] and impede personalized treatment strategies
- Signs are strongly related to venous pathology
- Mechanisms underlying symptoms are unclear

For more details, read our publication:

SCAN ME

7. Rabinovich et al, JTH, 2018; 8. Amin EE et al, Thromb Haemost, 2018; 9. Méan M et al, Thromb Haemost, 2018

Acknowledgments

Investigators of the **IDEAL-DVT trial**

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Received **training fellowships** from **ISTH** and **CARIM** for visit to **Johannes Gutenberg University of Mainz**

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