

Hemostasis Abnormalities in Covid-19

Armando Tripodi

Angelo Bianchi Bonomi

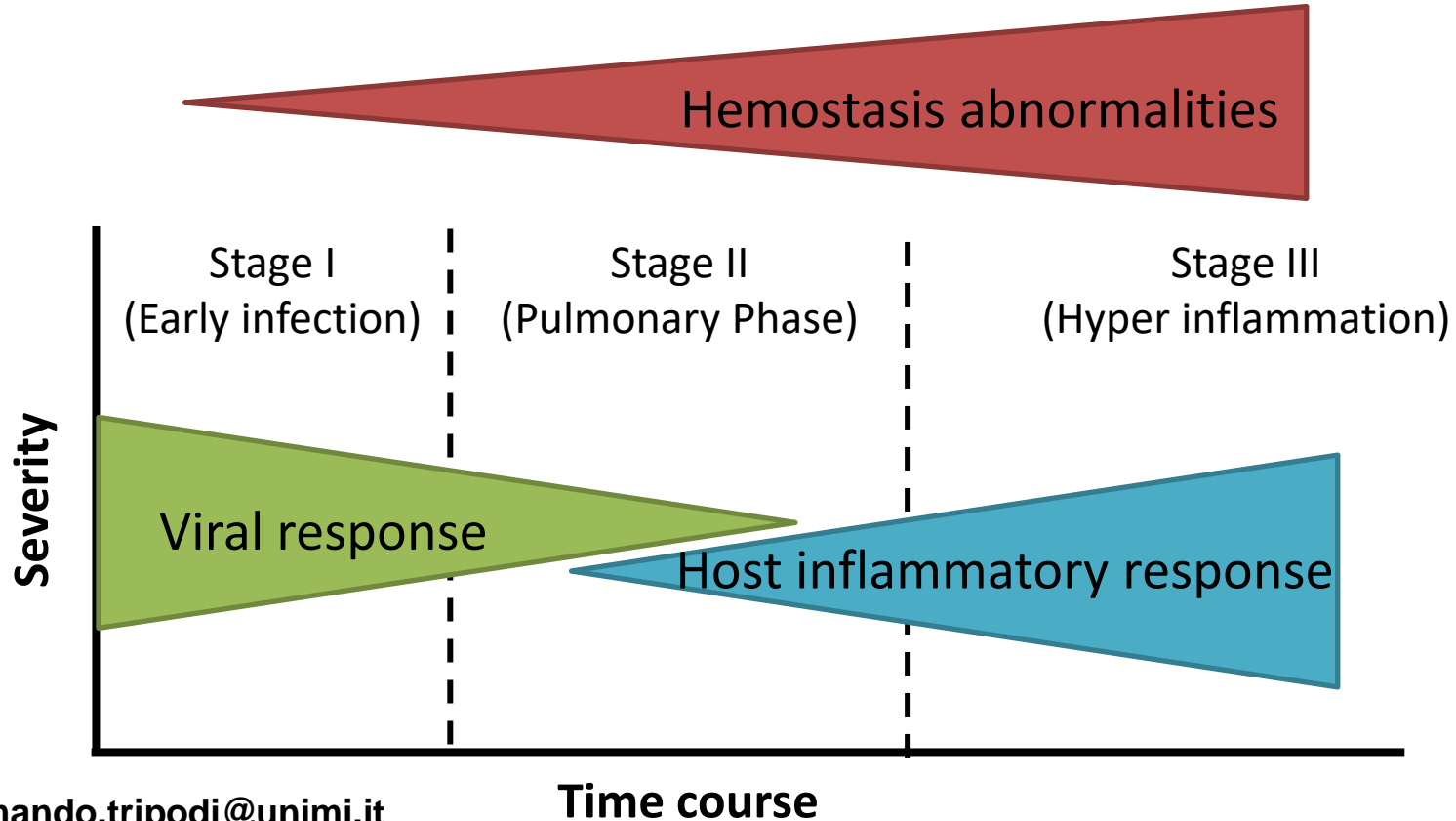
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and Humanitas University

Milano, Italy

Covid-19 Pathogenesis



Covid-19 & Hemostasis

- High plasma levels of proinflammatory cytokines (IL-2, IL-6, IL-7, TNF- α) observed in patients admitted to ICU
- Promote considerable derangement of hemostasis and endothelial dysfunction, leading to fibrin deposition and vascular occlusion

Risk Factors Associated With Acute Respiratory Distress Syndrome and Death in Patients With Coronavirus Disease 2019 Pneumonia in Wuhan, China

Chaomin Wu, MD; Xiaoyan Chen, MD; Yanping Cai, MD; Jia'an Xia, MD; Xing Zhou, MD; Sha Xu, MD;

Table 4. Bivariate Cox Regression of Factors Associated With ARDS Development or Progression From ARDS to Death

Patient characteristics and findings	ARDS		Death	
	HR (95% CI)	P value	HR (95% CI)	P value
IL-6, pg/L	1.02 (1.00-1.05)	.09	1.03 (1.01-1.05)	.01
Coagulation function				
PT, s	1.56 (1.32-1.83)	<.001	1.08 (0.84-1.38)	.54
APTT, s	0.97 (0.94-1.01)	.13	0.96 (0.91-1.00)	.06
D-dimer, $\mu\text{g/mL}$	1.03 (1.01-1.04)	<.001	1.02 (1.01-1.04)	.002

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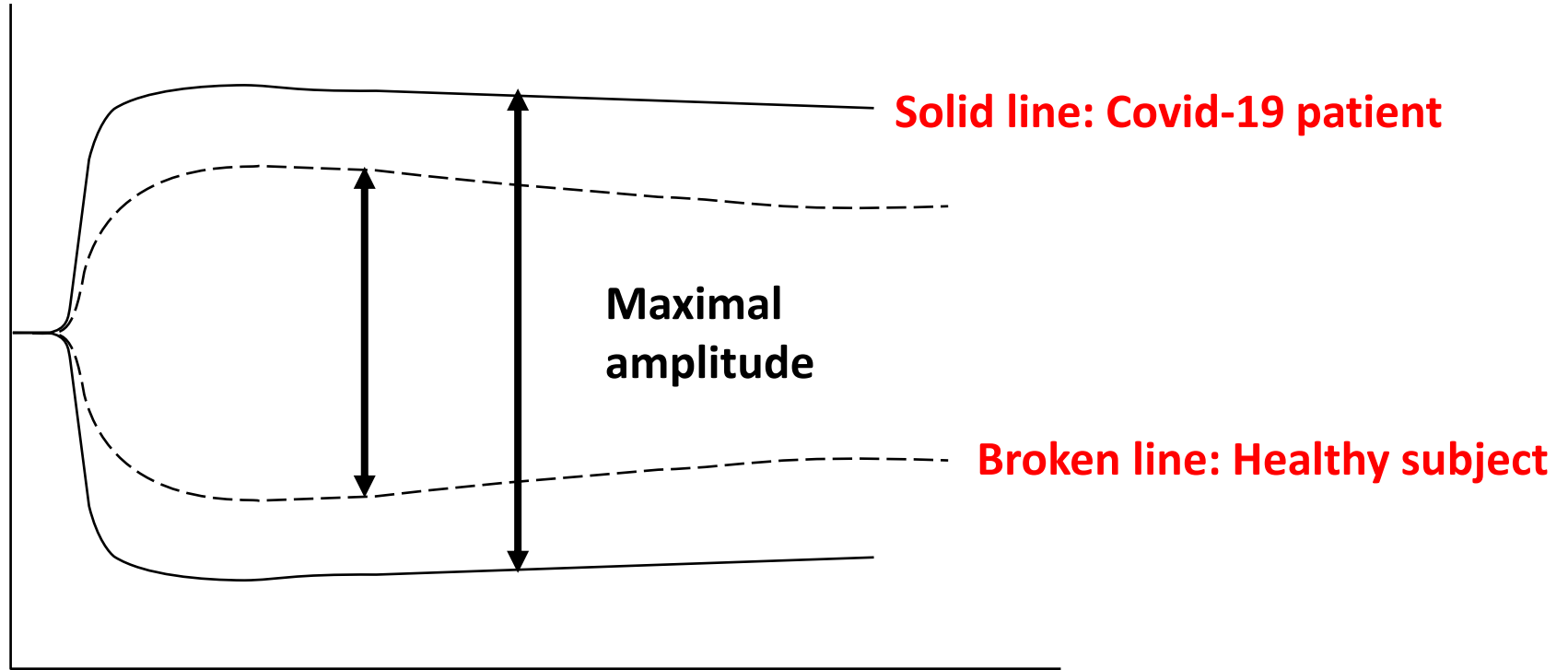
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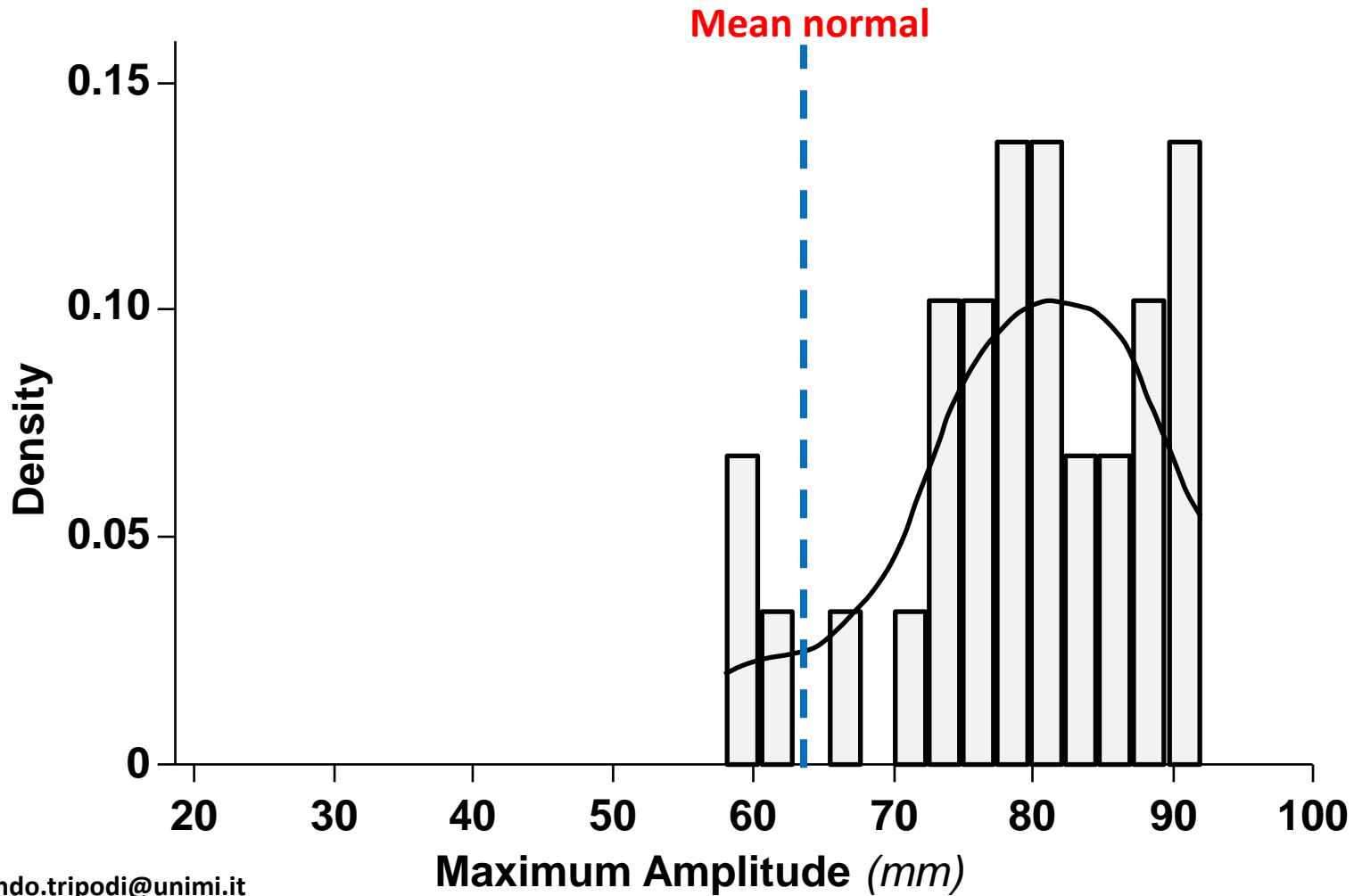
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Hypercoagulability of COVID-19 patients in intensive care unit: A report of thromboelastography findings and other parameters of hemostasis

Mauro Panigada¹ | Nicola Bottino¹ | Paola Tagliabue¹ | Giacomo Grasselli² |
Cristina Novembrino³ | Veena Chantarangkul³ | Antonio Pesenti^{1,2} | Flora Peyvandi^{2,3} |
Armando Tripodi³

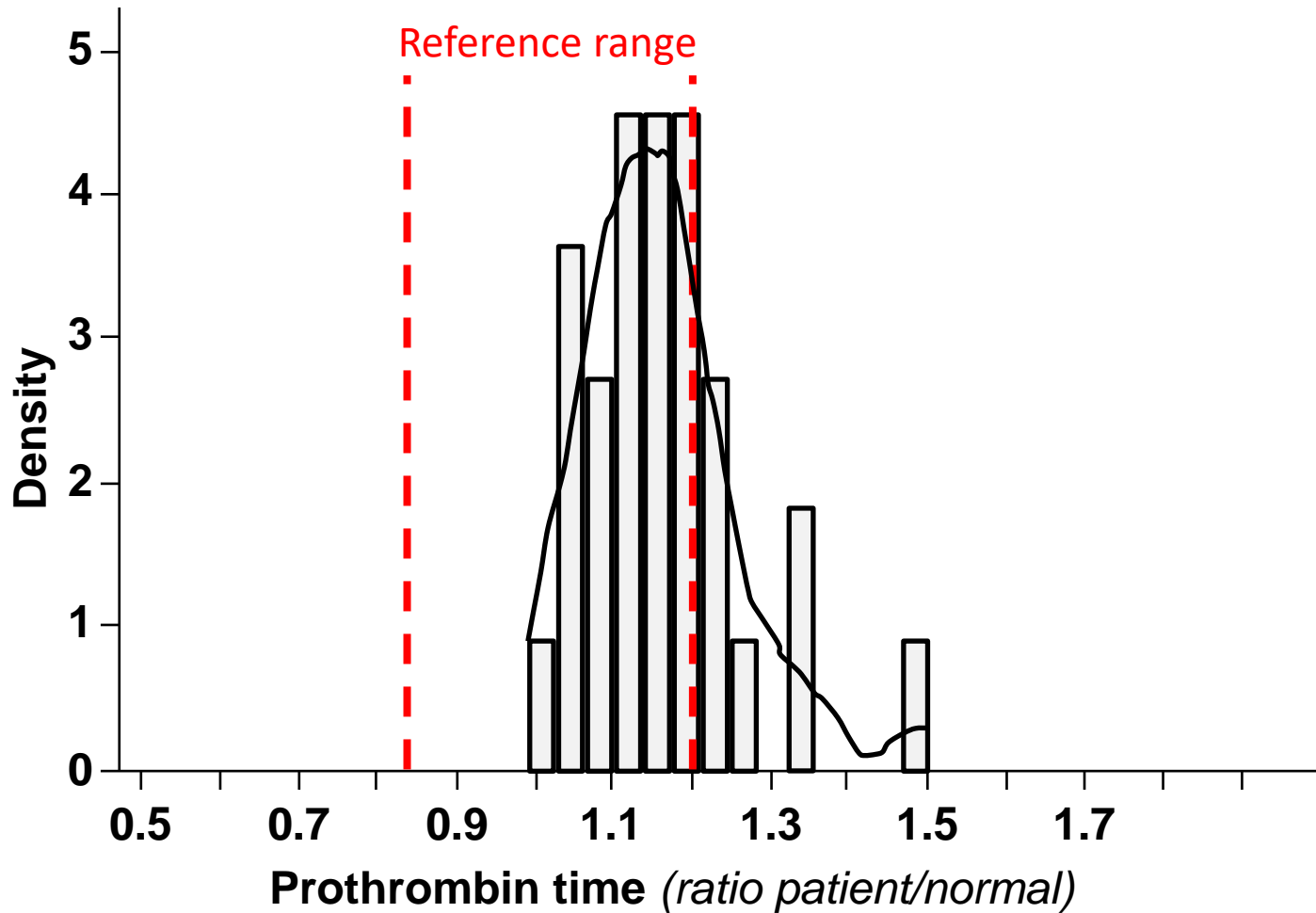
Typical Viscoelastic Tracings

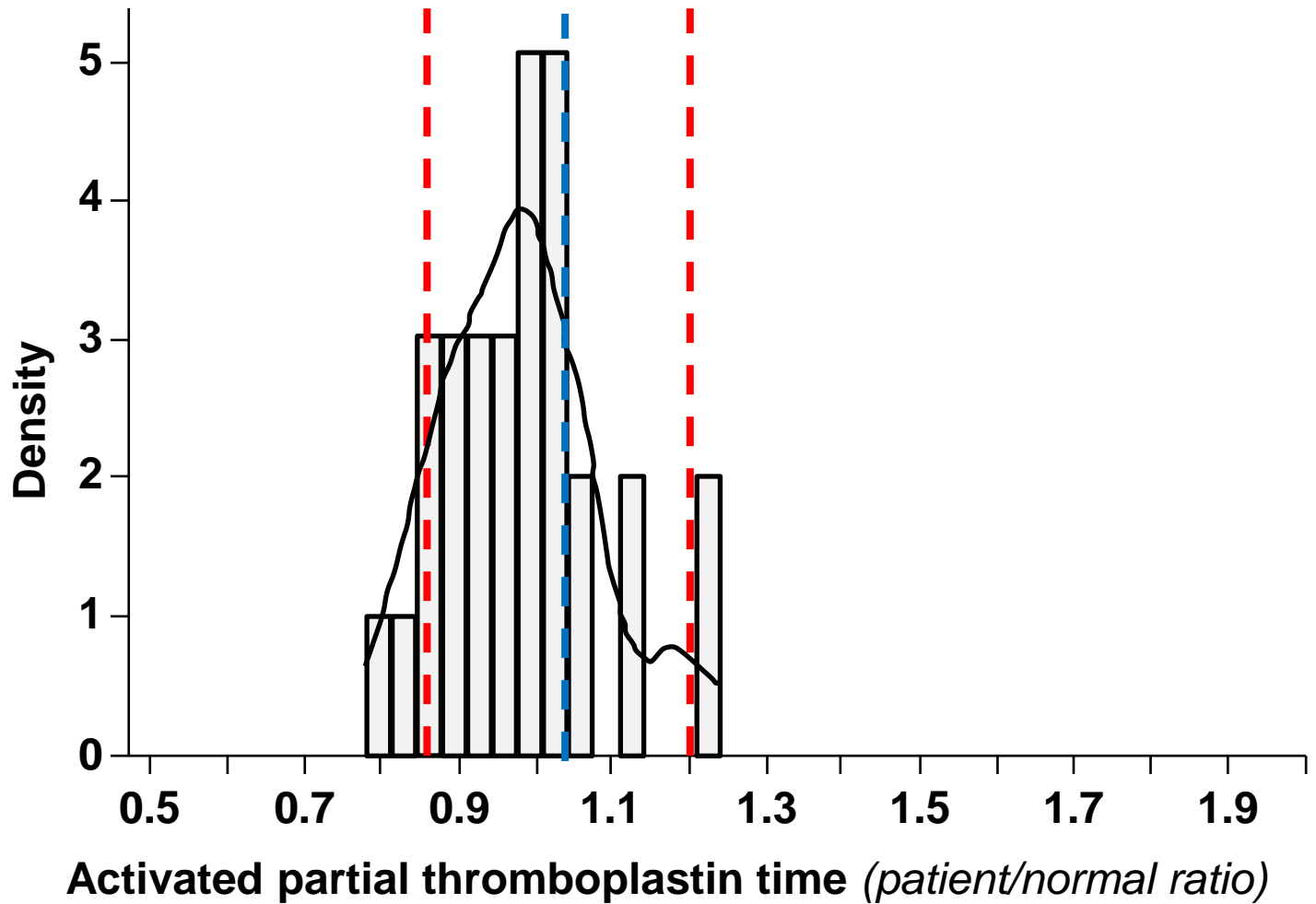


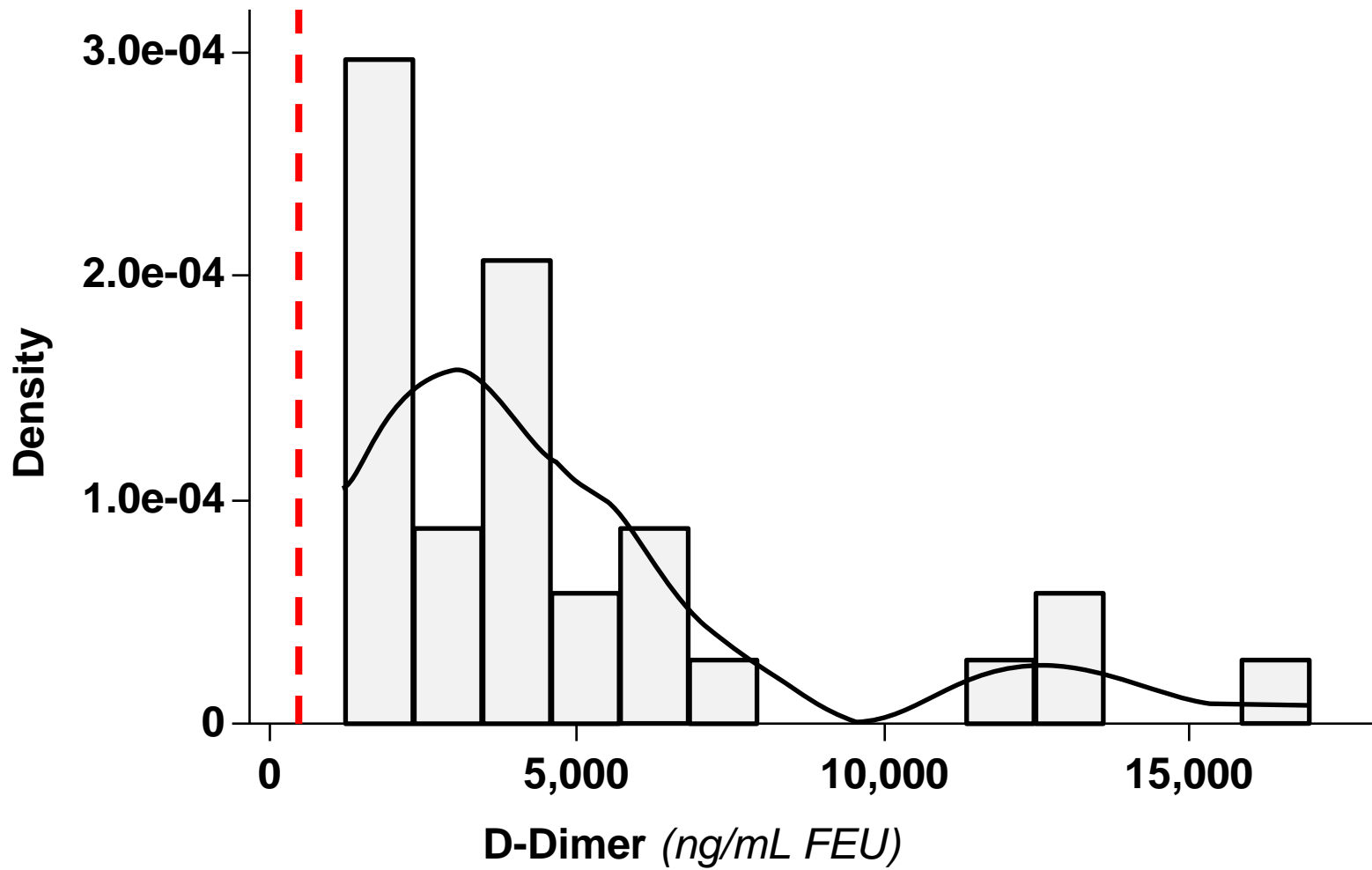


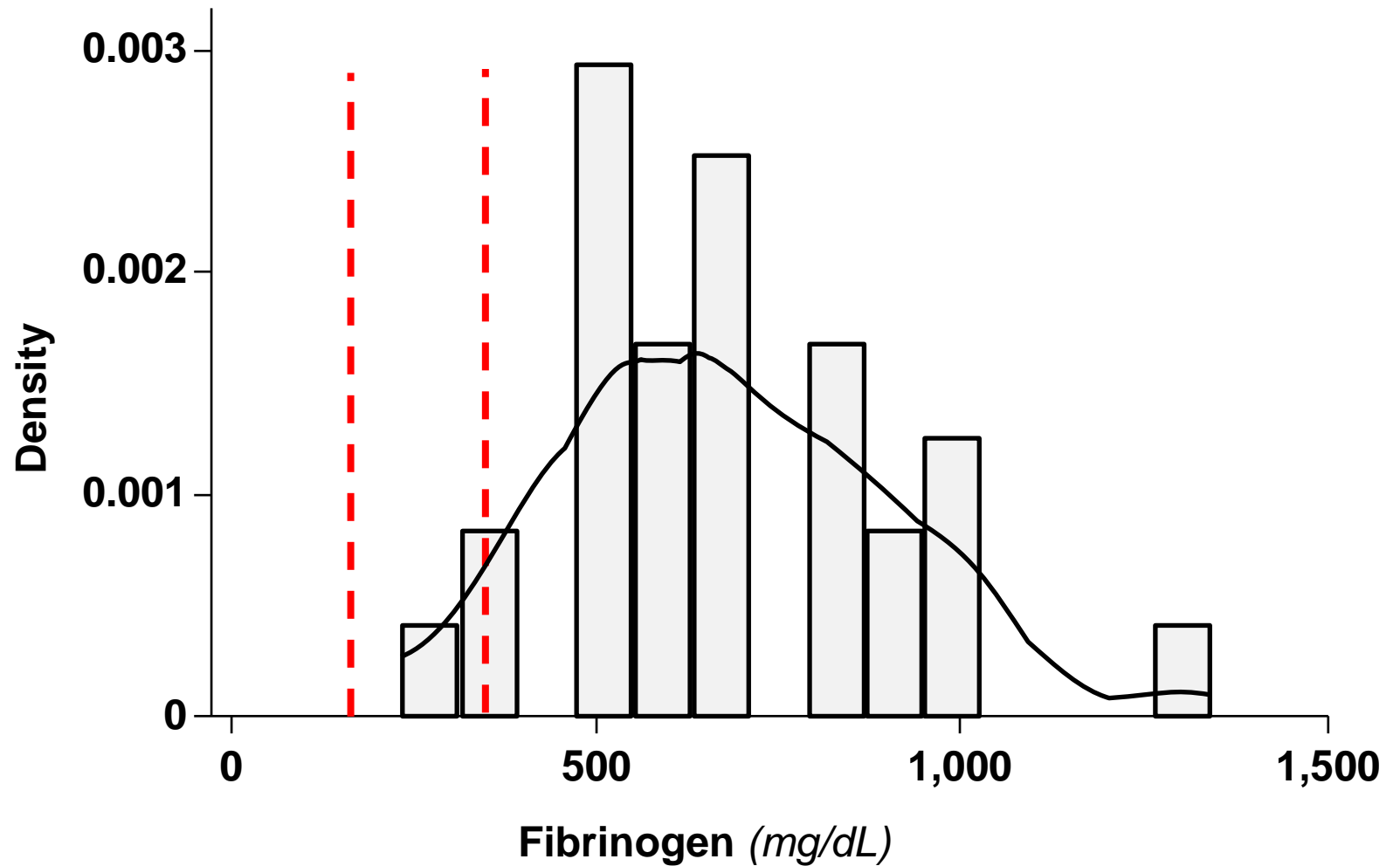
Summary

*Viscoelastic parameters denote
hypercoagulability*



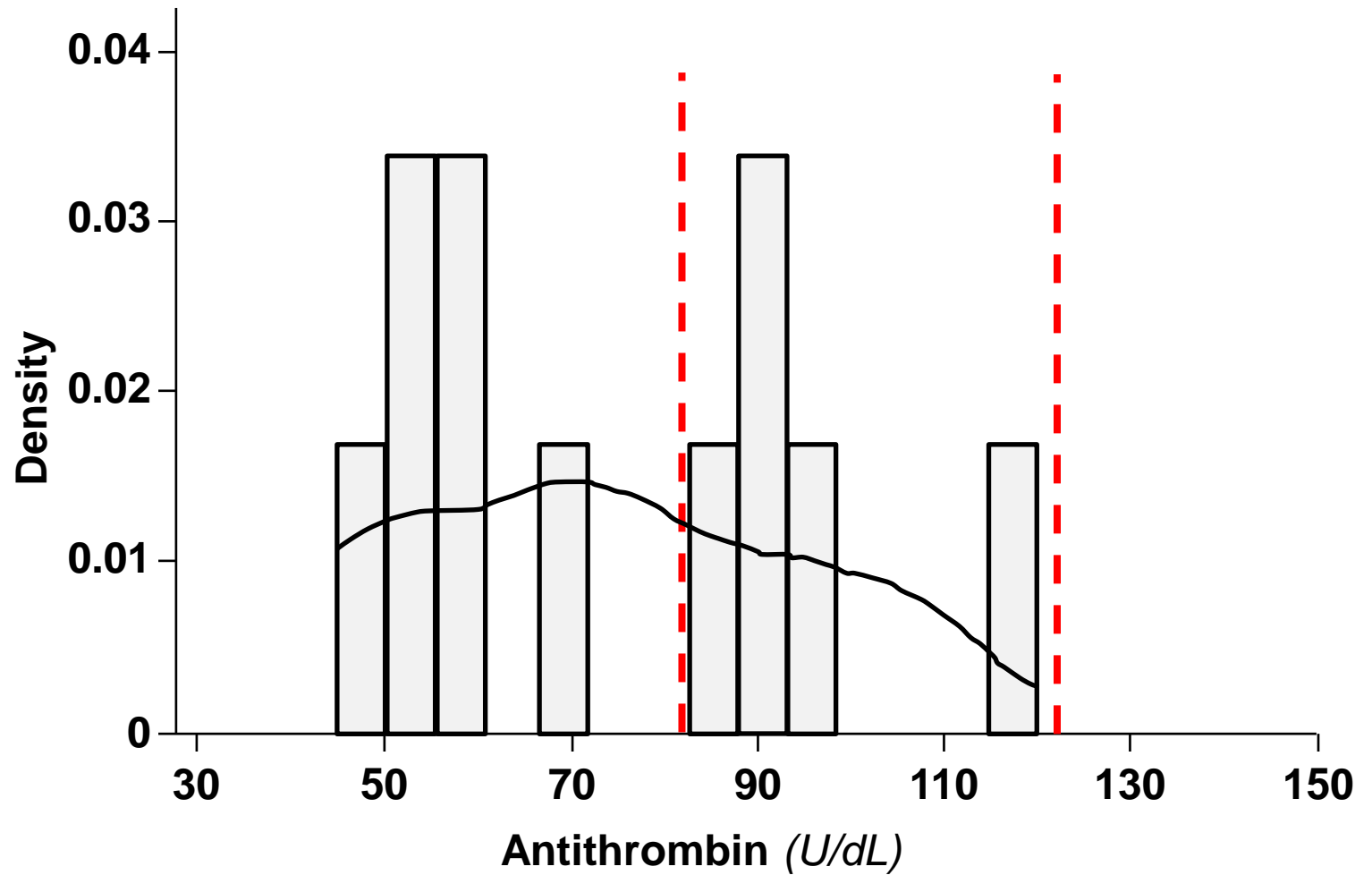


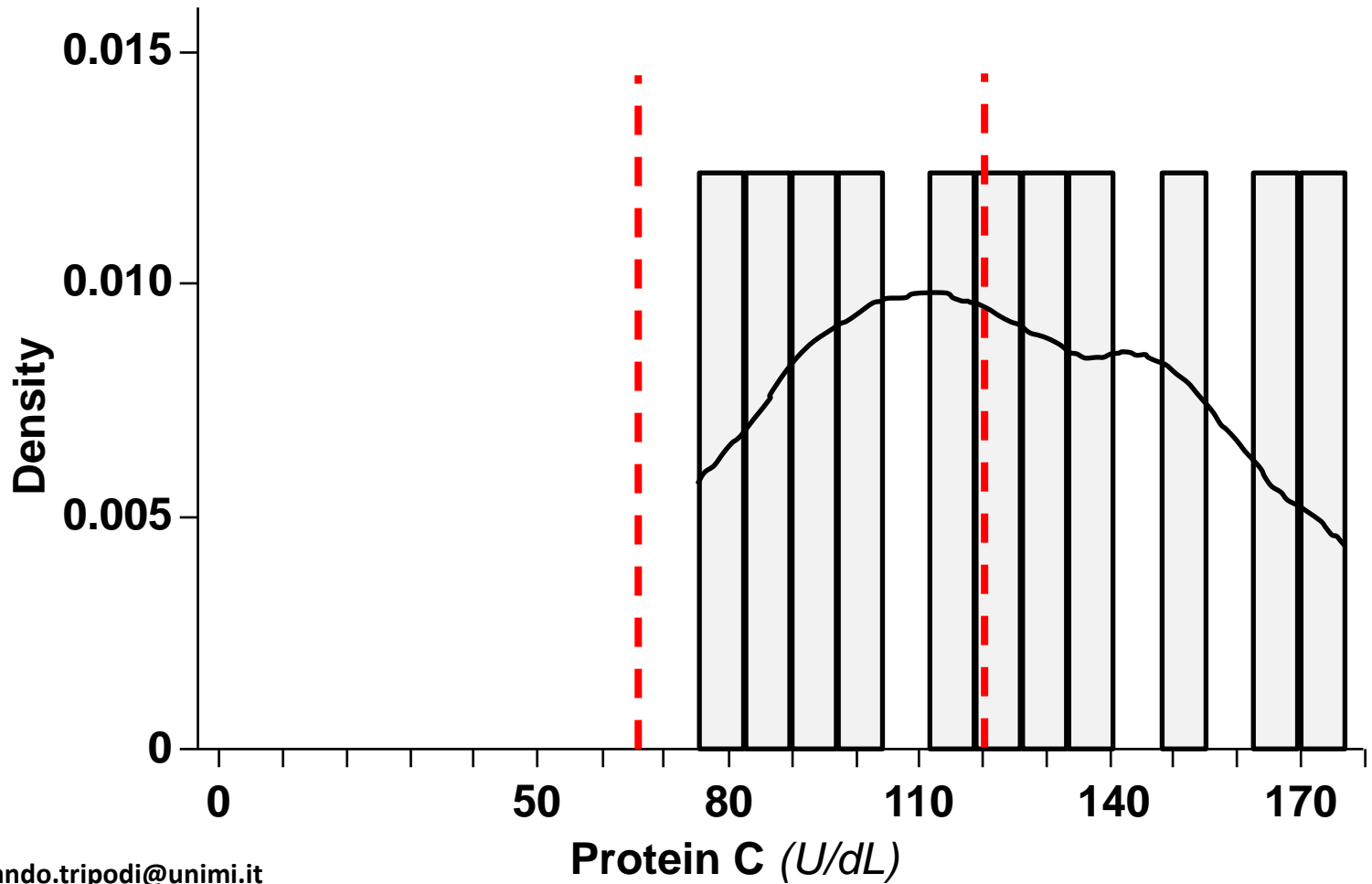


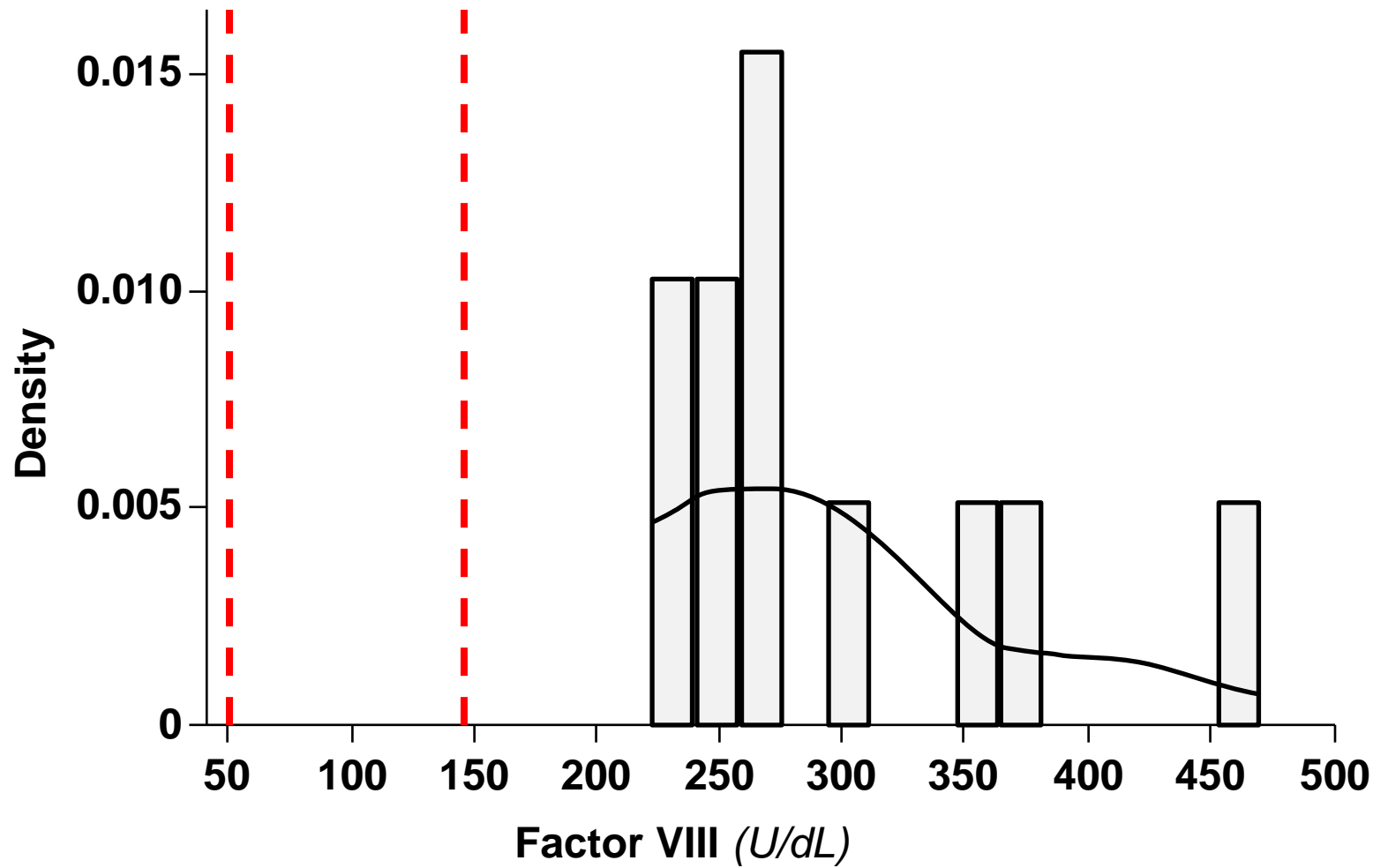


Summary

*Among hemostasis parameters only elevated
D dimer is consistent with DIC*

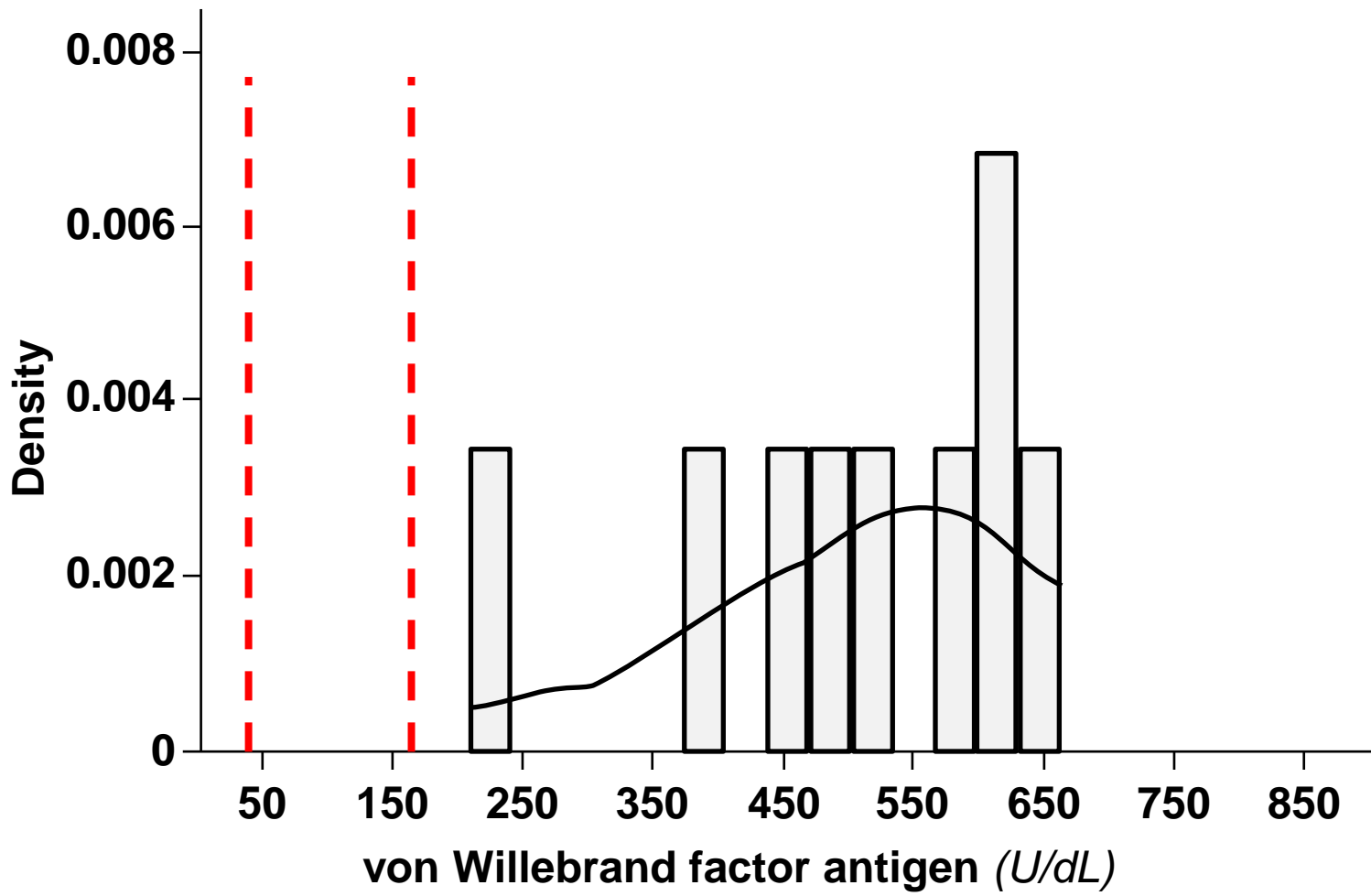


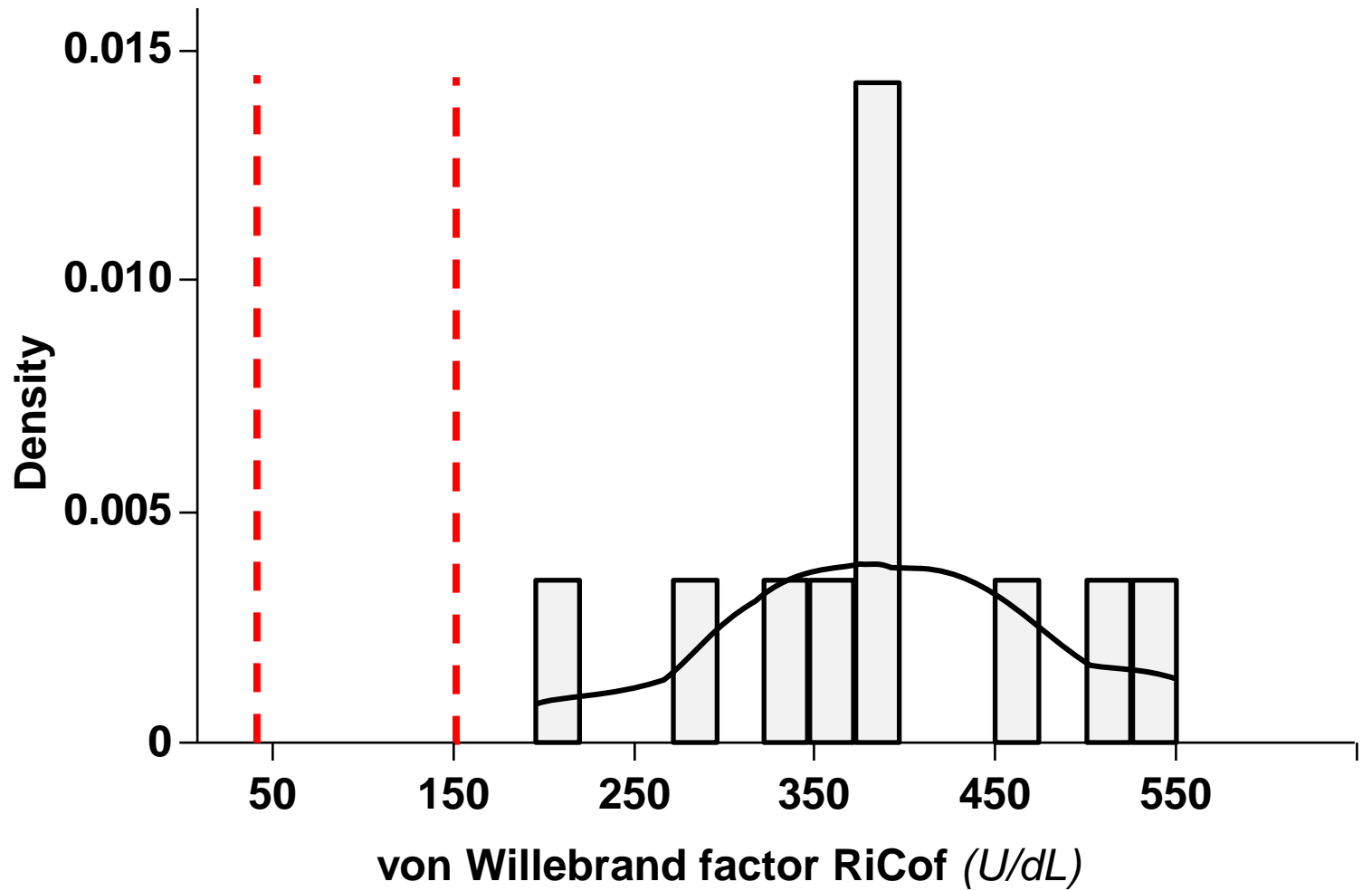




Summary

Pro- and anti-coagulant parameters are consistent with hypercoagulability





Summary

*von Willebrand factor levels are
consistent with dramatic endothelial
dysfunction*



Journal of The Ferrata Storti Foundation

Hemostatic alterations in COVID-19

by Flora Peyvandi , Andrea Artoni, Cristina Novembrino, Stefano Aliberti, Mauro Panigada, Marco Boscarino, Roberta Gualtierotti , Federica Rossi, Roberta Palla , Ida Martinelli, Giacomo Grasselli, Francesco Blasi, and Armando Tripodi

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Study Characteristics

- Aim
 - To see if hemostatic abnormalities progress along with Covid-19 severity
- Design
 - 66 hospitalized patients were divided according to the intensity of treatment care (low, intermediate, high)

Intensity Treatment Care

- Low
 - Ventilation support
- Intermediate
 - Continuous positive air pressure (CPAP)
- High
 - Intubation and mechanical ventilation

Measurements

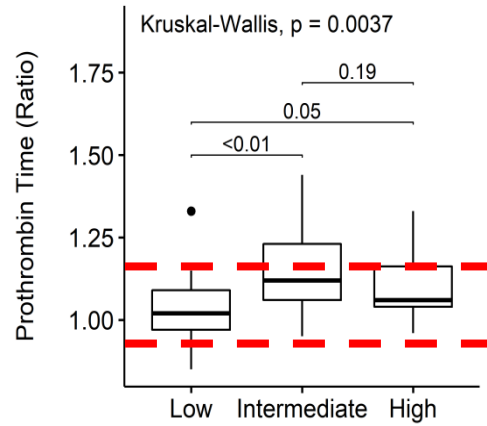
- DIC parameters
 - PT, Plts, Fibrinogen, D Dimer
- Pro- and anticoagulant parameters
 - Factor VIII, antithrombin, protein C/S
- Endothelial parameters
 - Von Willebrand factor
- Inflammatory parameters
 - C-reactive protein, ferritin

DIC

Parameters

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DIC Parameters



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Fig. 1

DIC Parameters

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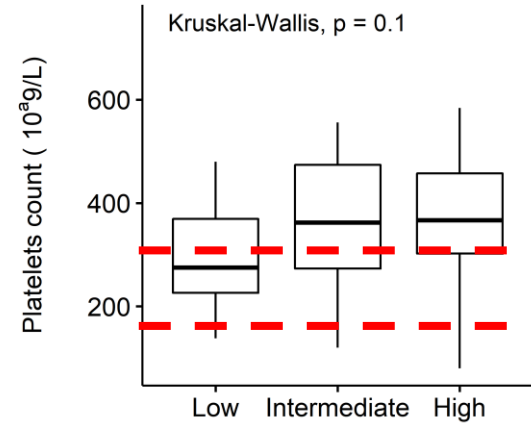
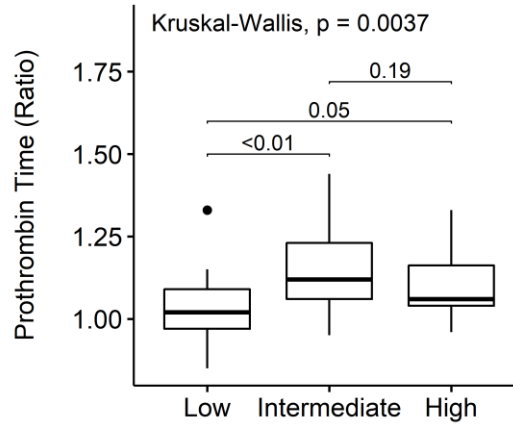
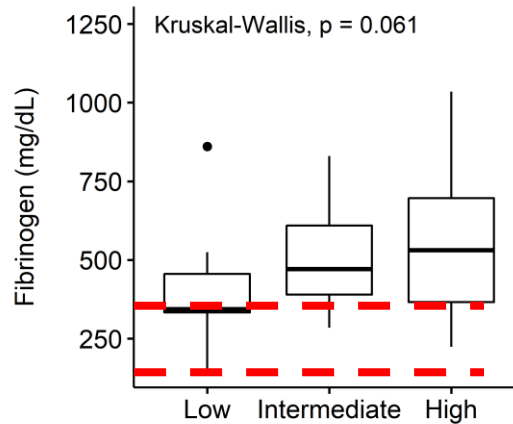
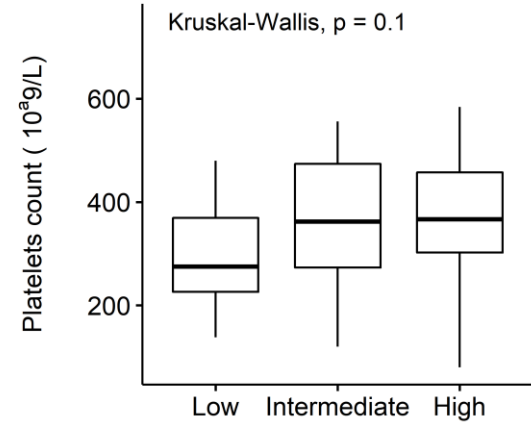
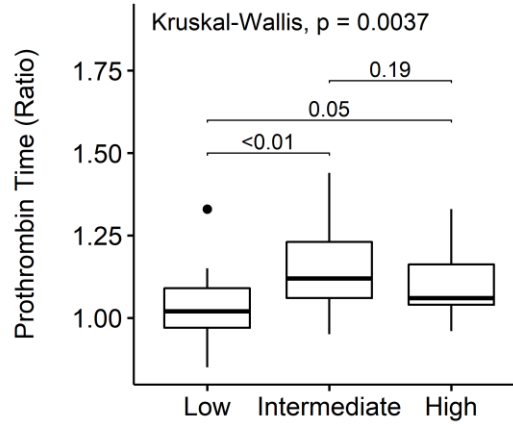
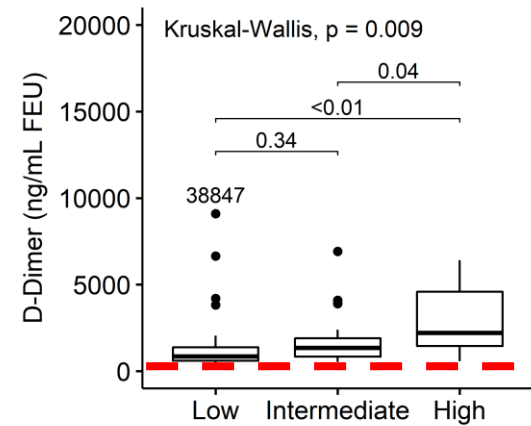
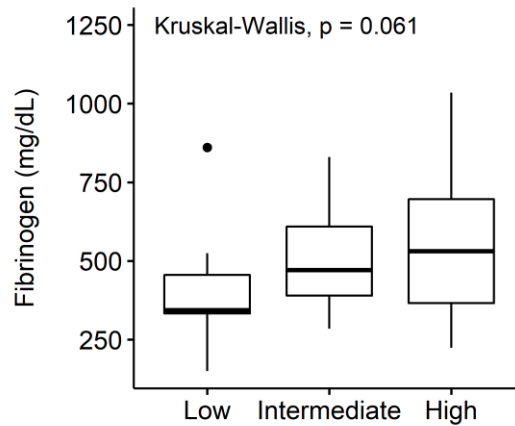
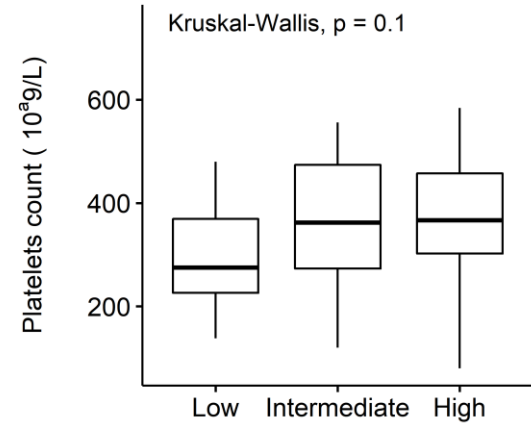
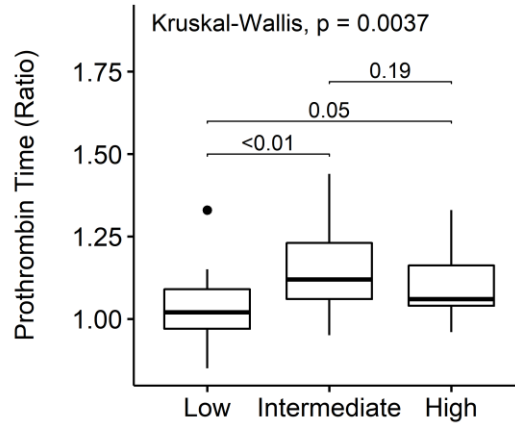


Fig. 1

DIC Parameters

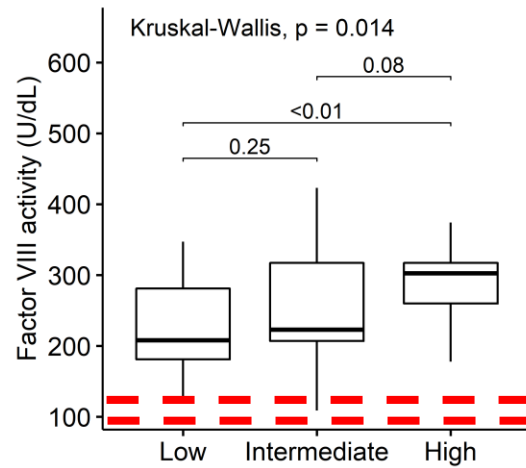


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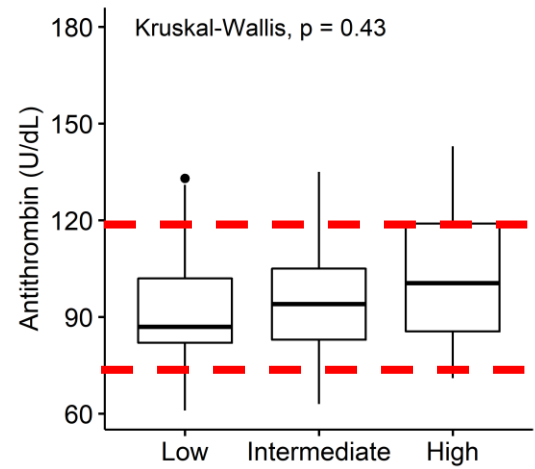
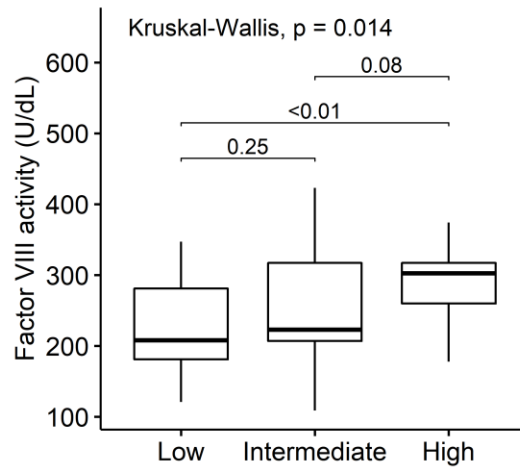


*Pro- and
anticoagulant
parameters*

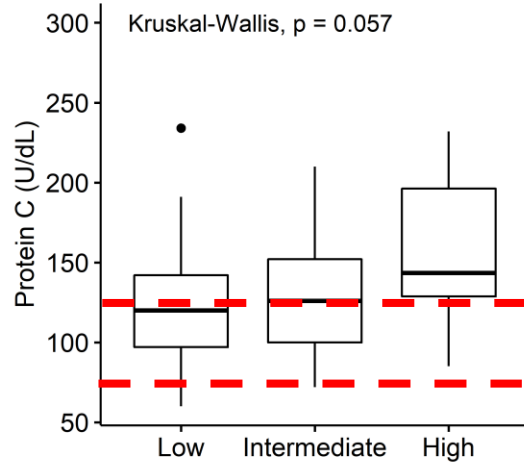
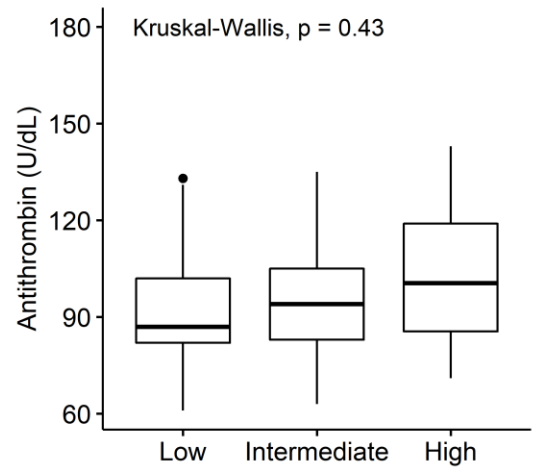
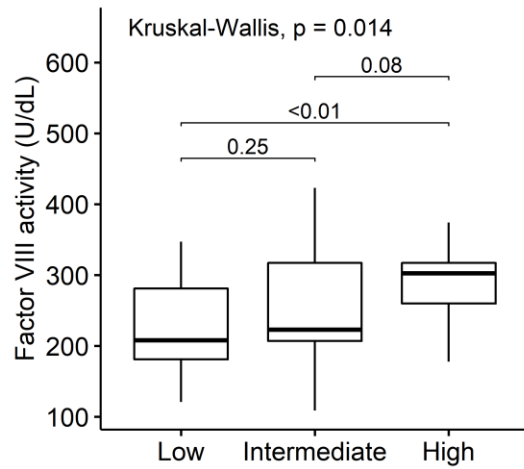
Pro- and anticoagulant parameters



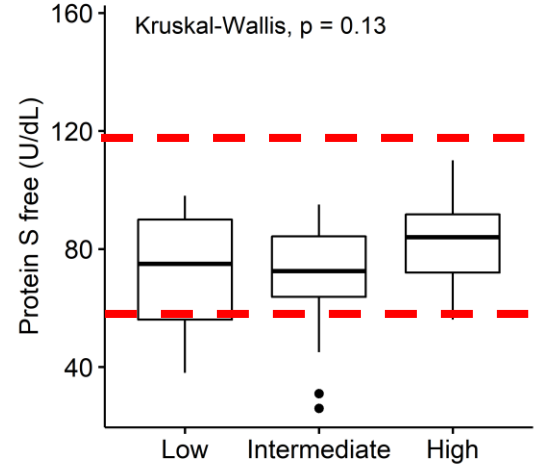
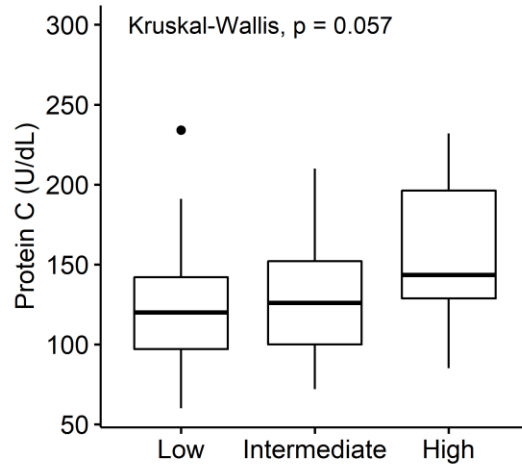
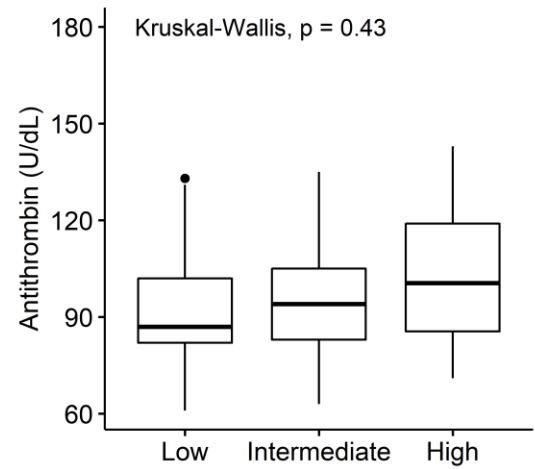
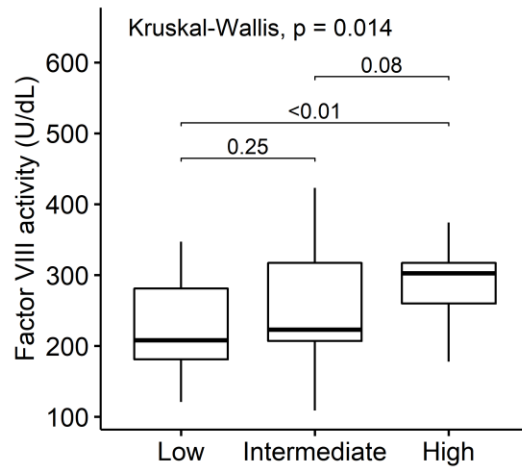
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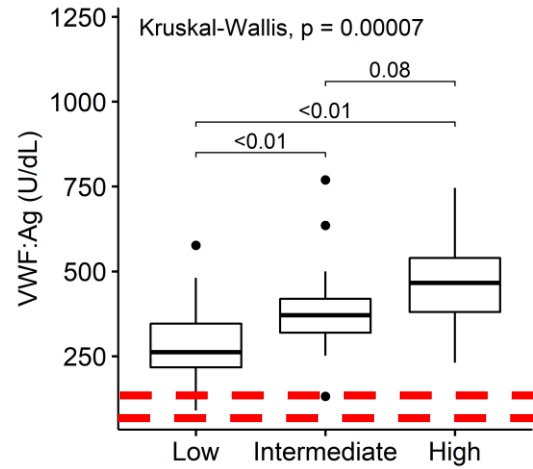


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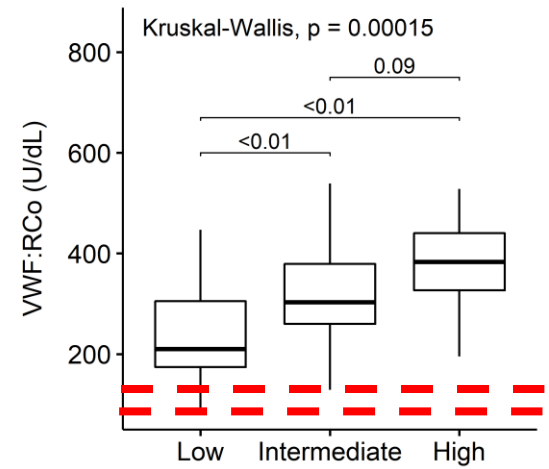
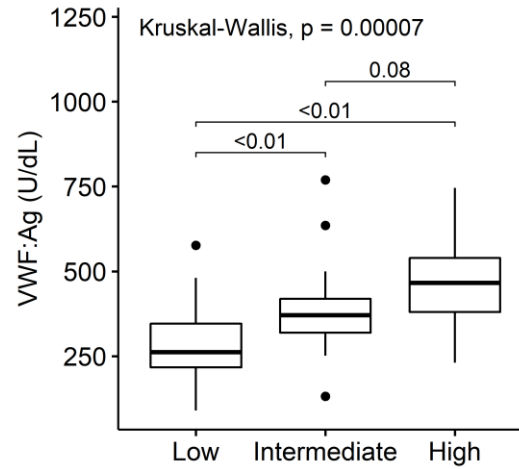


Endothelial Parameters

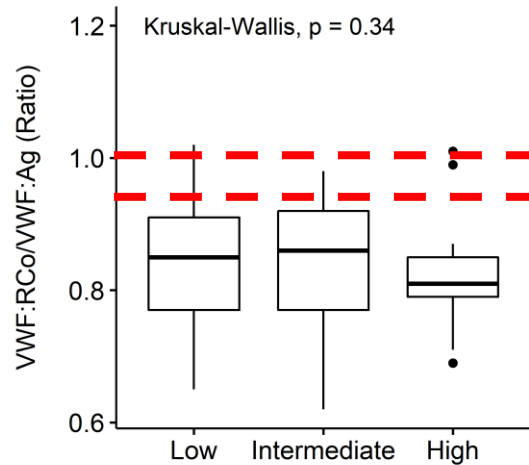
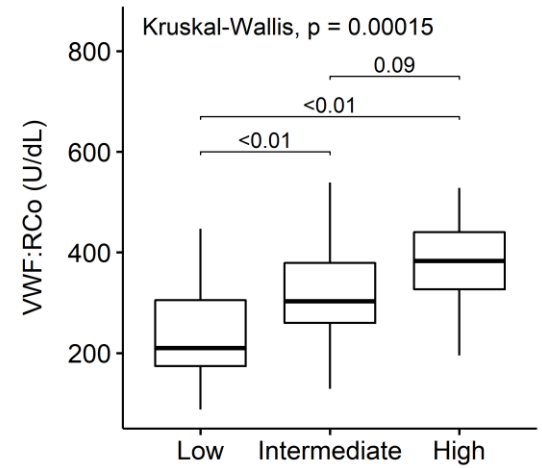
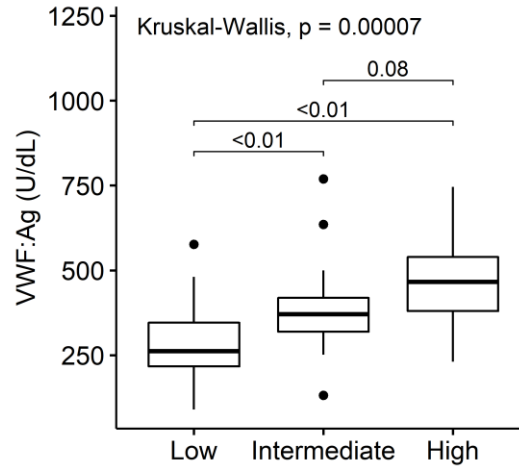
Endothelial Parameters



Endothelial Parameters



Endothelial Parameters



Inflammatory Parameters

Inflammatory Parameters

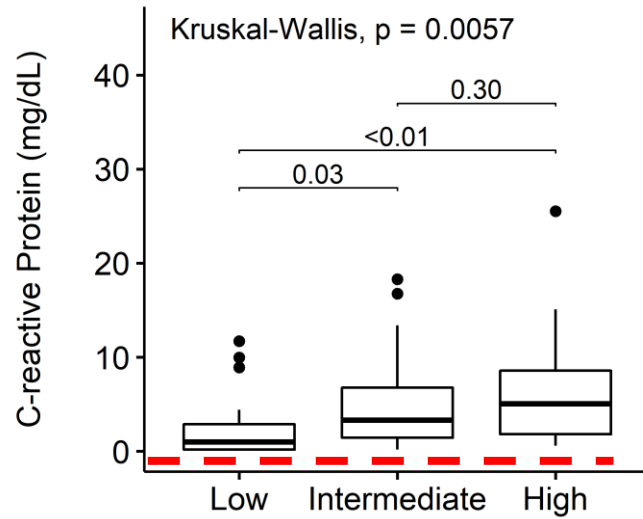


Fig. 4

Inflammatory Parameters

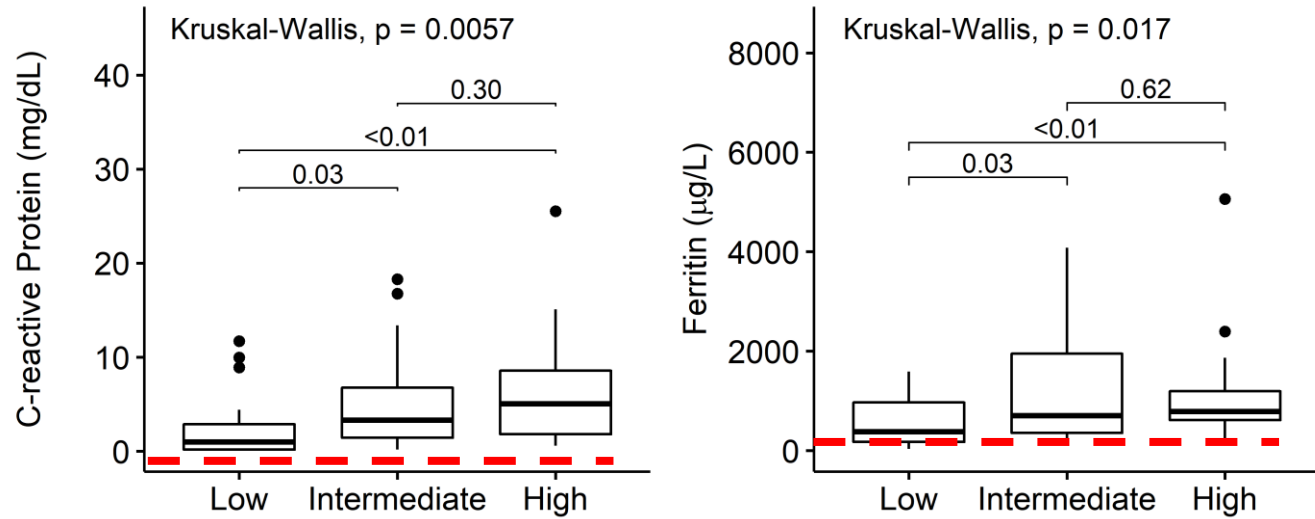


Fig. 4

Covid-19 & Hemostasis Abnormalities

Conclusions

- Covid-19 presents with considerable derangement of hemostasis that may vary according to disease progression
- Abnormalities are not entirely consistent with DIC and consumption coagulopathy, at least in ICU patients
- ICU patients possess an evident state of hypercoagulability and endothelial dysfunction