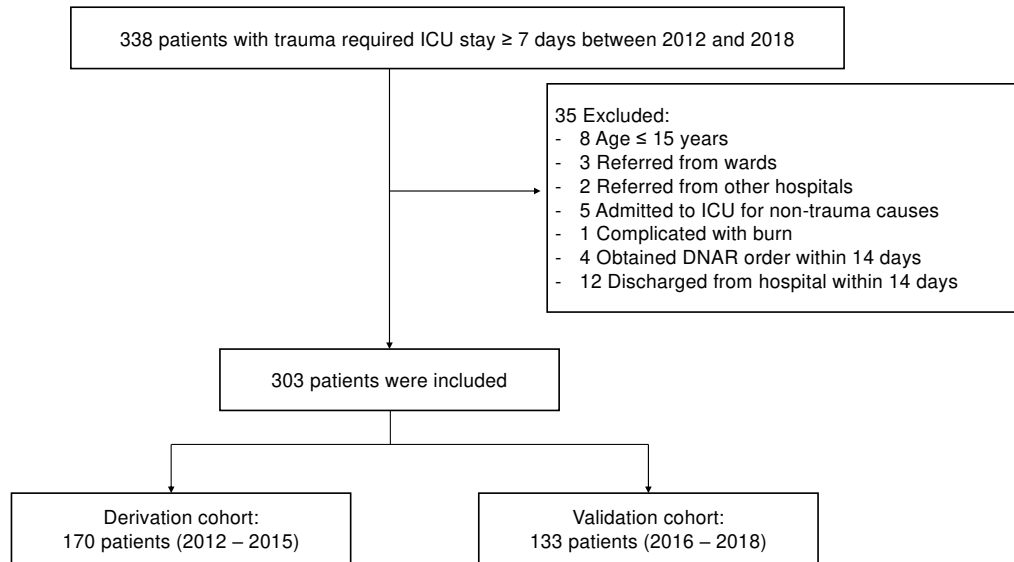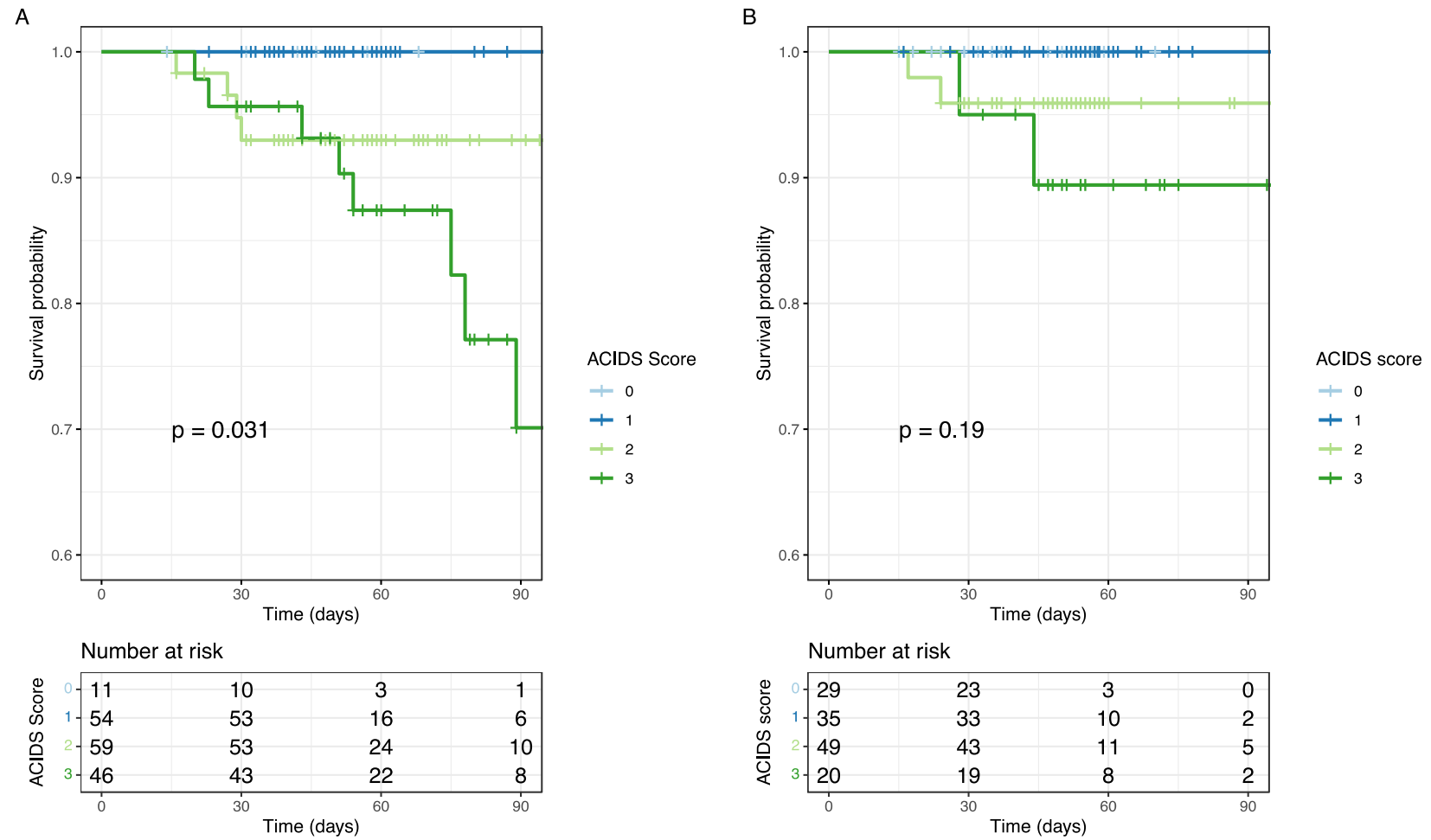Supplemental Digital Content

Development and validation of prediction scores for persistent inflammation, immunosuppression, and catabolism syndrome among trauma patients who required a protracted ICU course

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338 patients with trauma required ICU stay ≥ 7 days between 2012 and 2018

35 Excluded:
- 8 Age ≤ 15 years
- 3 Referred from wards
- 2 Referred from other hospitals
- 5 Admitted to ICU for non-trauma causes
- 1 Complicated with burn
- 4 Obtained DNAR order within 14 days
- 12 Discharged from hospital within 14 days

303 patients were included

Derivation cohort:
170 patients (2012 – 2015)

Validation cohort:
133 patients (2016 – 2018)

Supplementary Fig 1. Study flowchart

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Supplementary Fig 2. Kaplan-Meier curves for the survival to discharge rate

(A, derivation cohort, n = 170; B, validation cohort, n = 133.)

Supplementary Table 1. Characteristics of patients in the derivation and validation cohort.

IQR, interquartile range; AIS, Abbreviated Injury Scale; CRP, C-reactive protein.

Characteristics	Derivation (n = 170)	Validation (n = 133)
Maximum AIS in each body region		
AIS for head, median (IQR)	1 (0–3)	3 (0–4)
AIS for face, median (IQR)	0 (0–0)	0 (0–0)
AIS for neck, median (IQR)	0 (0–0)	0 (0–0)
AIS for chest, median (IQR)	4 (3–4)	3 (0–4)
AIS for abdomen, median (IQR)	0 (0–3)	0 (0–0)
AIS for spine, median (IQR)	0 (0–3)	0 (0–3)
AIS for upper extremities, median (IQR)	0 (0–2)	0 (0–2)
AIS for lower extremities, median (IQR)	0 (0–3)	1 (0–3)
AIS for external, median (IQR)	0 (0–0)	0 (0–0)
Mechanism of injuries		
Motor vehicle collision, occupant, n (%)	39 (22.9)	26 (19.5)
Motor vehicle collision, motorcycle, n (%)	31 (18.2)	13 (9.8)
Motor vehicle collision, bicycle, n (%)	11 (6.5)	20 (15.0)
Motor vehicle collision, pedestrian, n (%)	27 (15.9)	19 (14.3)
Fall from height, n (%)	19 (11.2)	8 (6.0)
Fall from stairs, n (%)	17 (10.0)	26 (19.5)

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Fall from standing, n (%)	2	(1.2)	4	(3.0)
Compression injury, n (%)	10	(5.9)	2	(1.5)
Stab wound, n (%)	2	(1.2)	1	(0.7)
Others, n (%)	12	(7.1)	14	(10.5)
Hospital course				
Intubation, n (%)	163	(95.9)	116	(87.2)
Emergency operation, n (%)	79	(52.7)	54	(40.6)
Days to start nutrition, median (IQR), days	4	(3.0–6.0)	2	(2.0–3.0)
Maximum CRP, median (IQR), mg/dL	21.8	(16.5–27.2)	18.5	(12.5–25.5)
Minimum albumin, median (IQR), g/dL	2.5	(2.3–2.6)	2.5	(2.3–2.7)
Episode of infection until day 7, n (%)	91	(53.5)	52	(39.1)
Pneumonia, n (%)	75	(44.1)	47	(35.3)
Surgical Site Infection, n (%)	5	(2.9)	1	(0.8)
Catheter related blood stream infection, n (%)	3	(1.8)	0	(0.0)
Peritonitis, n (%)	4	(2.4)	1	(0.8)
Others, n (%)	4	(2.4)	2	(1.5)
Length of stay in ICU ≥ 14 days, n (%)	64	(37.6)	48	(36.1)
Tracheostomy, n (%)	136	(80.0)	82	(61.7)
Mechanical ventilation days ≥ 96 hours, n (%)	157	(96.3)	113	(85.0)
Poor wound healing, n (%)	27	(15.9)	16	(12.0)
Renal replacement therapy, n (%)	26	(15.3)	19	(14.3)

Supplementary Table 2. Sensitivity, specificity, and positive and negative predictive value of each score to predict PICS.

Data were shown with calculated value by defining as having that score or higher, and 95% confidence interval.

PPV, positive predictive value; NPV, negative predictive value; PICS, persistent inflammation, immunosuppression, and catabolism syndrome.

Cut-off score	Derivation cohort				Validation cohort			
	Sensitivity	Specificity	PPV	NPV	Sensitivity	Specificity	PPV	NPV
1	0.97 (0.90–1.00)	0.09 (0.04–0.16)	0.41 (0.33–0.49)	0.82 (0.48–0.98)	0.96 (0.85–0.99)	0.31 (0.21–0.41)	0.42 (0.32–0.52)	0.93 (0.77–0.99)
2	0.84 (0.73–0.92)	0.52 (0.42–0.62)	0.53 (0.43–0.63)	0.83 (0.72–0.91)	0.76 (0.61–0.87)	0.61 (0.50–0.71)	0.51 (0.38–0.63)	0.83 (0.71–0.91)
3	0.48 (0.35–0.60)	0.86 (0.78–0.92)	0.70 (0.54–0.82)	0.72 (0.63–0.79)	0.26 (0.14–0.41)	0.91 (0.83–0.96)	0.60 (0.36–0.81)	0.70 (0.61–0.78)

Supplementary Table 3. Multivariable logistic regression model assessing the occurrence of PICS-related composite outcome
ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

	Derivation cohort (n = 170)			Validation cohort (n = 133)		
Variables	Odds ratio	95%CI	p value	Odds ratio	95%CI	p value
ACIDS Score	3.18	(2.04, 4.97)	<0.001	2.66	(1.66, 4.24)	<0.001
Age, yr	0.57	(0.28, 1.15)	0.117	1.00	(0.98, 1.02)	0.81
ISS	1.003	(0.98, 1.03)	0.797	1.02	(0.98, 1.06)	0.34
SBP on arrival, mmHg	0.99	(0.99, 1.00)	0.156	1.00	(0.99, 1.01)	0.40
GCS on arrival	0.99	(0.91, 1.08)	0.839	0.93	(0.84, 1.03)	0.15

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Supplementary Table 4. Multivariable logistic regression model assessing in-hospital mortality
ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

Variables	Derivation cohort (n = 170)			Validation cohort (n = 133)		
	Odds ratio	95%CI	p value	Odds ratio	95%CI	p value
ACIDS Score	4.61	(1.64, 12.95)	< 0.01	5.73	(0.87, 37.6)	0.07
Age, yr	1.01	(0.98, 1.04)	0.59	0.99	(0.93, 1.04)	0.62
ISS	1.02	(0.97, 1.07)	0.40	0.97	(0.90, 1.05)	0.45
SBP on arrival, mmHg	1.00	(0.98, 1.01)	0.80	0.99	(0.97, 1.02)	0.57
GCS on arrival	0.93	(0.81, 1.07)	0.31	0.82	(0.63, 1.07)	0.14

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Supplementary Table 5. Multivariable logistic regression model assessing multiple episodes of infection
ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

Variables	Derivation cohort (n = 170)			Validation cohort (n = 133)		
	Odds ratio	95%CI	p value	Odds ratio	95%CI	p value
ACIDS Score	2.54	(1.68, 3.83)	<0.001	1.62	(1.06, 2.47)	0.03
Age, yr	1.01	(0.99, 1.03)	0.42	1.02	(1.00, 1.04)	0.12
ISS	1.01	(0.99, 1.04)	0.39	0.99	(0.96, 1.03)	0.76
SBP on arrival, mmHg	1.00	(0.99, 1.01)	0.37	1.01	(1.00, 1.02)	0.37
GCS on arrival	0.99	(0.92, 1.07)	0.85	0.91	(0.82, 1.00)	0.05

Supplementary Table 6. Multivariable linear regression model assessing SOFA score at day 14
SOFA, Sequential Organ Failure Assessment; ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

Variables	Derivation cohort (n = 170)			Validation cohort (n = 133)		
	Coefficient	95%CI	p value	Coefficient	95%CI	p value
ACIDS Score	0.66	(0.25, 1.08)	< 0.01	0.91	(0.50, 1.32)	< 0.001
Age, yr	0.03	(0.01, 0.05)	< 0.01	0.03	(0.01, 0.05)	< 0.01
ISS	0.00	(-0.03, 0.03)	0.94	0.03	(-0.01, 0.07)	0.09
SBP on arrival, mmHg	-0.01	(-0.02, -0.001)	0.04	0.001	(-0.01, 0.01)	0.89
GCS on arrival	-0.08	(-0.17, 0.01)	0.07	-0.13	(-0.23, -0.03)	0.01

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Supplementary Table 7. Multivariable linear regression model assessing duration of mechanical ventilation
ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

Variables	Derivation cohort (n = 170)			Validation cohort (n = 133)		
	Coefficient	95%CI	p value	Coefficient	95%CI	p value
ACIDS Score	4.42	(2.06, 6.78)	<0.001	2.82	(1.87, 3.77)	<0.001
Age, yr	0.02	(-0.09, 0.13)	0.78	0.03	(-0.02, 0.08)	0.22
ISS	0.00	(-016, 0.16)	0.97	0.14	(0.05, 0.22)	0.00
SBP on arrival, mmHg	-0.04	(-0.09, 0.02)	0.19	0.00	(-0.03, 0.02)	0.93
GCS on arrival	-0.22	(-0.72, 0.28)	0.39	-0.29	(-0.52, -0.06)	0.02

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Supplementary Table 8. Multivariable linear regression model assessing length of stay in ICU
ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

	Derivation cohort (n = 170)			Validation cohort (n = 133)		
Variables	Coefficient	95%CI	p value	Coefficient	95%CI	p value
ACIDS Score	2.26	(1.25, 0.20)	<0.001	1.92	(1.07, 2.77)	<0.001
Age, yr	-0.05	(-0.10, -0.01)	0.03	0.03	(-0.02, 0.07)	0.22
ISS	0.004	(-0.072, 0.064)	0.91	0.03	(-0.04, 0.11)	0.40
SBP on arrival, mmHg	-0.03	(-0.05, -0.003)	0.03	-0.01	(-0.03, 0.01)	0.37
GCS on arrival	0.01	(-0.35, 0.08)	0.23	-0.05	(-0.26, 0.16)	0.61

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Supplementary Table 9. Multivariable linear regression model assessing length of stay in hospital
ISS, Injury Severity Score; SBP, systolic blood pressure; GCS, Glasgow Coma Scale.

Variables	Derivation cohort (n = 170)			Validation cohort (n = 133)		
	Coefficient	95%CI	p value	Coefficient	95%CI	p value
ACIDS Score	11.72	(3.75, 19.69)	0.004	3.97	(-0.84, 8.77)	0.11
Age, yr	-0.54	(-0.92, -0.17)	0.01	0.13	(-0.10, 0.36)	0.27
ISS	0.10	(-044, 0.64)	0.71	0.08	(-0.36, 0.51)	0.73
SBP on arrival, mmHg	-0.13	(-0.30, 0.05)	0.16	-0.04	(-0.16, 0.08)	0.54
GCS on arrival	0.07	(-1.62, 1.77)	0.93	-0.66	(-1.84, 0.52)	0.27