

Variable	Missing values, n	Missing rate (%)
BMI	216	18.31
ALT_first	136	11.53
TBil_first	124	10.51
Lac_std	112	9.49
Lac_slope	112	9.49
BE_std	107	9.07
BE_slope	107	9.07
PaO2_std	107	9.07
PaCO2_slope	107	9.07
PaCO2_std	107	9.07
PaO2_slope	107	9.07
Glu_last	92	7.80
pH_slope	88	7.46
pH_std	88	7.46
BE_first	87	7.37
PaO2_first	87	7.37
PaCO2_first	87	7.37
Lac_first	83	7.03
pH_first	79	6.69
Temperature_last	39	3.31
Temperature_first	35	2.97
Temperature_slope	31	2.63
Temperature_std	31	2.63
BE_mean	18	1.53
PaO2_mean	18	1.53
Temperature_mean	18	1.53
PaCO2_mean	18	1.53
Lac_mean	17	1.44
APTT_first	16	1.36
Glu_first	16	1.36
PT_first	13	1.10
pH_mean	8	0.68
SpO2_first	4	0.34
HR_first	2	0.17
SBP_first	2	0.17
SpO2_last	2	0.17
DBP_first	2	0.17
MAP_first	2	0.17
RR_first	2	0.17
SpO2_slope	1	0.08
RR_last	1	0.08
SpO2_std	1	0.08

pH_diff_abs_sum	0	0.00
Glu_diff_abs_sum	0	0.00
Glu_mean	0	0.00
Glu_std	0	0.00
Glu_slope	0	0.00
SpO2_diff_abs_sum	0	0.00
SpO2_mean	0	0.00
Lac_diff_abs_sum	0	0.00
PaCO2_diff_abs_sum	0	0.00
BE_diff_abs_sum	0	0.00
EPI_mean	0	0.00
EPI_std	0	0.00
EPI_slope	0	0.00
EPI_last	0	0.00
EPI_first	0	0.00
DA_diff_abs_sum	0	0.00
DA_mean	0	0.00
DA_std	0	0.00
DA_slope	0	0.00
DA_last	0	0.00
DA_first	0	0.00
VP_diff_abs_sum	0	0.00
VP_mean	0	0.00
VP_std	0	0.00
VP_slope	0	0.00
VP_last	0	0.00
VP_first	0	0.00
NE_diff_abs_sum	0	0.00
NE_mean	0	0.00
NE_std	0	0.00
NE_slope	0	0.00
NE_last	0	0.00
NE_first	0	0.00
UO_diff_abs_sum	0	0.00
UO_mean	0	0.00
UO_std	0	0.00
UO_slope	0	0.00
UO_last	0	0.00
UO_first	0	0.00
PaO2_diff_abs_sum	0	0.00
Temperature_diff_abs_sum	0	0.00
RR_diff_abs_sum	0	0.00
RR_mean	0	0.00

SCr_first	0	0.00
RBC_first	0	0.00
PLT_first	0	0.00
WBC_first	0	0.00
Number of vasoactive agents	0	0.00
EPI	0	0.00
DA	0	0.00
VP	0	0.00
NE	0	0.00
Charlson index	0	0.00
GCS	0	0.00
CRRT	0	0.00
Mechanical ventilation	0	0.00
AKI	0	0.00
Rheumatic disease	0	0.00
HIV/AIDS	0	0.00
Metastatic solid tumor	0	0.00
Malignancy	0	0.00
Peptic ulcer disease	0	0.00
Dementia	0	0.00
Cerebrovascular disease	0	0.00
Chronic lung disease	0	0.00
Chronic kidney disease	0	0.00
Liver disease	0	0.00
Heart failure	0	0.00
Myocardial infarction	0	0.00
Diabetes	0	0.00
Age	0	0.00
Sex	0	0.00
BUN_first	0	0.00
Total Ca_first	0	0.00
Cl_first	0	0.00
SBP_diff_abs_sum	0	0.00
RR_std	0	0.00
RR_slope	0	0.00
MAP_diff_abs_sum	0	0.00
MAP_mean	0	0.00
MAP_std	0	0.00
MAP_slope	0	0.00
MAP_last	0	0.00
DBP_diff_abs_sum	0	0.00
DBP_mean	0	0.00
DBP_std	0	0.00

DBP_slope	0	0.00
DBP_last	0	0.00
SBP_mean	0	0.00
Glu_first	0	0.00
SBP_std	0	0.00
SBP_slope	0	0.00
SBP_last	0	0.00
HR_diff_abs_sum	0	0.00
HR_mean	0	0.00
HR_std	0	0.00
HR_slope	0	0.00
HR_last	0	0.00
Phosphate_first	0	0.00
Mg_first	0	0.00
Hb_first	0	0.00
Na_first	0	0.00
K_first	0	0.00
EPI_diff_abs_sum	0	0.00

Supplementary Table 1. Missingness of candidate variables in the MIMIC-IV development cohort

Variable	Overall (n=1747)	Survival during hospitalization (n=1231)	Death during hospitalization (n=516)	P
Demographics				
Male (%)	992 (56.8%)	694 (56.4%)	298 (57.8%)	0.597
Age (yr)	66.00 [55.00, 75.00]	65.00 [54.00, 75.00]	68.00 [58.00, 76.00]	<0.001
BMI (kg/m ²)	27.90 [23.72, 34.34]	28.58 [24.35, 34.97]	26.71 [22.45, 32.52]	<0.001
Comorbidities				
Diabetes (%)	590 (33.8%)	420 (34.1%)	170 (32.9%)	0.636
Myocardial infarction (%)	160 (9.2%)	115 (9.3%)	45 (8.7%)	0.681
Heart failure (%)	319 (18.3%)	226 (18.4%)	93 (18.0%)	0.868
Liver disease (%)	128 (7.3%)	73 (5.9%)	55 (10.7%)	<0.001
Chronic kidney disease (%)	356 (20.4%)	247 (20.1%)	109 (21.1%)	0.616
Chronic pulmonary disease (%)	294 (16.8%)	194 (15.8%)	100 (19.4%)	0.065
Cerebrovascular disease (%)	168 (9.6%)	114 (9.3%)	54 (10.5%)	0.436
Dementia (%)	81 (4.6%)	57 (4.6%)	24 (4.7%)	0.985

Malignancy (%)	262 (15.0%)	174 (14.1%)	88 (17.1%)	0.119
AKI (%)	1451 (83.1%)	981 (79.7%)	470 (91.1%)	<0.001
Severity and therapies				
GCS	6.00 [3.00, 9.00]	7.00 [3.00, 10.00]	3.00 [3.00, 7.00]	<0.001
Charlson index	4.00 [2.00, 6.00]	4.00 [2.00, 6.00]	5.00 [3.00, 7.00]	<0.001
Mechanical ventilation (%)	1566 (89.6%)	1077 (87.5%)	489 (94.8%)	<0.001
Number of vasoactive agents	1.00 [1.00, 2.00]	1.00 [1.00, 2.00]	1.00 [1.00, 2.00]	<0.001
NE (%)	1027 (58.8%)	736 (59.8%)	291 (56.4%)	0.189
VP (%)	806 (46.1%)	527 (42.8%)	279 (54.1%)	<0.001
DA (%)	283 (16.2%)	196 (15.9%)	87 (16.9%)	0.627
EPI (%)	224 (12.8%)	146 (11.9%)	78 (15.1%)	0.063
Laboratory parameters				
WBC ($\times 10^9/L$)	13.50 [8.70, 20.10]	13.50 [8.70, 20.00]	13.70 [8.70, 20.68]	0.714
PLT ($\times 10^9/L$)	170.00 [110.00, 239.25]	171.00 [114.00, 241.00]	166.00 [99.00, 227.25]	0.020
RBC ($\times 10^{12}/L$)	3.47 [2.94, 4.00]	3.49 [2.97, 4.05]	3.42 [2.88, 3.90]	0.004
Hb (g/dL)	10.20 [8.80, 11.90]	10.30 [8.90, 12.00]	10.00 [8.60, 11.80]	0.041
SCr (mg/dL)	1.79 [1.12, 2.99]	1.77 [1.10, 2.99]	1.80 [1.15, 3.00]	0.517
BUN (mg/dL)	33.00 [21.00, 51.00]	32.00 [21.00, 51.00]	34.00 [22.00, 53.00]	0.186
PT (s)	17.20 [14.70, 21.60]	16.90 [14.50, 20.75]	17.95 [15.33, 24.00]	<0.001
ALT (U/L)	35.00 [20.00, 82.00]	33.00 [18.00, 76.00]	39.00 [23.00, 114.00]	<0.001
TBil (mg/dL)	0.90 [0.50, 1.70]	0.90 [0.50, 1.60]	1.00 [0.57, 2.30]	0.002
Cl (mmol/L)	106.00 [101.00, 110.00]	105.00 [101.00, 110.00]	106.00 [100.00, 110.00]	0.837
Glucose (mg/dL)	133.00 [102.00, 180.50]	133.00 [103.00, 178.00]	134.00 [100.00, 183.00]	0.775

K (mmol/L)	4.10 [3.60, 4.70]	4.10 [3.60, 4.70]	4.20 [3.60, 4.72]	0.246
Na (mmol/L)	138.00 [134.00, 142.00]	138.00 [134.50, 142.00]	139.00 [134.00, 143.00]	0.332
Mg (mg/dL)	1.80 [1.50, 2.10]	1.80 [1.50, 2.10]	1.80 [1.60, 2.10]	0.008
P (mg/dL)	3.80 [2.60, 5.10]	3.60 [2.50, 4.90]	4.10 [2.80, 5.60]	<0.001
Time-varying variables				
HR_mean (bpm)	91.62 [80.80, 102.88]	90.78 [80.32, 101.81]	93.49 [82.26, 104.96]	0.002
SBP_mean (mmHg)	110.78 [103.13, 118.69]	111.30 [103.70, 119.12]	109.82 [101.02, 116.85]	0.008
DBP_mean (mmHg)	56.38 [51.02, 61.99]	56.99 [51.71, 62.50]	55.30 [49.44, 60.87]	<0.001
MAP_mean (mmHg)	74.25 [69.02, 79.82]	75.20 [70.10, 80.25]	72.71 [67.18, 78.59]	<0.001
RR_mean (/min)	20.48 [17.49, 23.89]	20.36 [17.42, 23.59]	20.84 [17.67, 24.42]	0.015
SpO ₂ _mean (%)	96.99 [95.56, 98.33]	97.06 [95.83, 98.33]	96.79 [94.88, 98.27]	<0.001
Glu_mean (mg/dL)	139.21 [118.69, 166.07]	139.86 [118.70, 165.93]	137.97 [118.55, 166.42]	0.773
Lac_mean (mmol/L)	2.29 [1.50, 3.80]	2.10 [1.40, 3.32]	2.95 [1.73, 5.08]	<0.001
pH_mean	7.36 [7.31, 7.40]	7.36 [7.32, 7.41]	7.35 [7.29, 7.39]	<0.001
PaCO ₂ _mean (mmHg)	37.82 [32.94, 43.08]	38.00 [33.00, 42.84]	37.60 [32.75, 43.77]	0.799
PaO ₂ _mean (mmHg)	102.30 [84.18, 130.61]	102.13 [84.00, 130.50]	103.10 [85.56, 131.53]	0.747
BE_mean (mmol/L)	-3.54 [-6.59, 0.19]	-3.13 [-6.31, 0.63]	-4.29 [-7.50, -0.70]	<0.001
UO_mean (mL/d)	2897.50 [1243.83, 3657.33]	3196.50 [2016.08, 4498.92]	2682.75 [464.25, 3696.21]	<0.001

Supplementary Table 2. Baseline and early clinical characteristics of the eICU-CRD external validation cohort