

Table S1. Variables of interest considered for AKI prediction model

Type	Variables	Measured in prior models (n)
<i>Demographic</i>	Age	44
<i>Demographic</i>	Sex	42
<i>Lab value</i>	Serum creatinine closest to 24 hour mark	21
<i>Demographic</i>	Body mass index	20
<i>Comorbid</i>	Smoking	18
<i>Comorbid</i>	Hypertension	16
<i>Comorbid</i>	DM	15
<i>Demographic</i>	Race	15
<i>Lab value</i>	eGFR	14
<i>Comorbid</i>	Congestive heart failure	13
<i>Comorbid</i>	Diabetes	13
<i>Comorbid</i>	Hypertension	13
<i>Comorbid</i>	Left ventricular ejection fraction	13
<i>Comorbid</i>	Chronic obstructive pulmonary disease (COPD)	11
<i>Comorbid</i>	Peripheral vascular disease (PVD)	9
<i>Surg detail</i>	cardiopulmonary bypass duration	8
<i>Comorbid</i>	Cerebrovascular disease	8
<i>Lab value</i>	Creatinine	8
<i>Lab value</i>	Hemoglobin	8
<i>Medication</i>	Aminoglycoside	7
<i>Comorbid</i>	Mechanic Ventilation	7
<i>Lab value</i>	Platelet count	7
<i>Lab value</i>	Albumin	6
<i>Lab value</i>	Bilirubin	6
<i>Comorbid</i>	CKD	6
<i>Medication</i>	Diuretic use	6
<i>Lab value</i>	Potassium	6
<i>Comorbid</i>	Sepsis	6
<i>Comorbid</i>	Anemia	5
<i>Comorbid</i>	Atrial fibrillation	5
<i>Lab value</i>	BUN	5
<i>Comorbid</i>	Cardiogenic shock	5
<i>Comorbid</i>	Coronary artery disease	5
<i>Comorbid</i>	Diabetes mellitus	5
<i>Demographic</i>	Height	5
<i>Comorbid</i>	IABP use	5
<i>Comorbid</i>	Previous MI	5
<i>Lab value</i>	Sodium	5

<i>Demographic</i>	Weight	5
<i>Lab value</i>	Calcium	4
<i>Comorbid</i>	Cerebrovascular accident	4
<i>Comorbid</i>	Chronic Lung Disease	4
<i>Surg detail</i>	Cross clamp time	4
<i>Comorbid</i>	Hypotension	4
<i>Medication</i>	NSAIDS	4
<i>Lab value</i>	pH	4
<i>Comorbid</i>	Previous PCI	4
<i>Lab value</i>	proteinuria	4
<i>Vital signs</i>	Systolic BP	4
<i>Vital signs</i>	Temperature	4
<i>Vital signs</i>	urine output	4
<i>Lab value</i>	WBC count	4
<i>Demographic</i>	Weight	4
<i>Lab value</i>	eGFR	3
<i>Lab value</i>	ALT	3
<i>Lab value</i>	AST	3
<i>Lab value</i>	Bicarbonate	3
<i>Comorbid</i>	Chronic liver disease	3
<i>Lab value</i>	glucose	3
<i>Vital signs</i>	Heart rate	3
<i>Lab value</i>	Hematocrit	3
<i>Comorbid</i>	Hyperlipidemia	3
<i>Comorbid</i>	Liver disease	3
<i>Surg detail</i>	Operative time	3
<i>Medication</i>	pRBC transfusion	3
<i>Medication</i>	vasopressor agent use	3
<i>Lab value</i>	Prothrombin time	3
<i>Comorbid</i>	Stroke	3
<i>Lab value</i>	Total bilirubin	3
<i>Medication</i>	Vancomycin	3
<i>Medication</i>	Calcium channel blocker	2
<i>Medication</i>	Inotropics	2
<i>Medication</i>	ACE inhibitors/ARB	2
<i>Surg detail</i>	aortic clamping duration	2
<i>Medication</i>	Beta-blocker use	2
<i>Medication</i>	Calcineurin inhibitor	2
<i>Comorbid</i>	Cancer	2
<i>Surg detail</i>	cardiopulmonary bypass (CPB)	2
<i>Comorbid</i>	Charlson score	2

<i>Comorbid</i>	Cirrhosis	2
<i>Comorbid</i>	CKD stage	2
<i>Lab value</i>	CRP	2
<i>Comorbid</i>	CV disease	2
<i>Surg detail</i>	CV surgery type (CABG;valve;other)	2
<i>Comorbid</i>	Ejection fraction	2
<i>Comorbid</i>	Endocarditis (yes/no)	2
<i>Medication</i>	Immunosuppressive treatment	2
<i>Medication</i>	IV Contrast	2
<i>Vital signs</i>	MAP	2
<i>Lab value</i>	MELD score	2
<i>Comorbid</i>	MI	2
<i>Comorbid</i>	NYHA CHF class	2
<i>Medication</i>	Other antibiotics	2
<i>Lab value</i>	Phosphorus	2
<i>Comorbid</i>	Previous cardiac surgery	2
<i>Comorbid</i>	prior CABG	2
<i>Comorbid</i>	prior cardiac surgery	2
<i>Comorbid</i>	prior valve surgery	2
<i>Comorbid</i>	Respiratory failure	2
<i>Vital signs</i>	Respiratory rate	2
<i>Lab value</i>	serum albumin	2
<i>Lab value</i>	serum sodium/Na	2
<i>Vital signs</i>	Severity of hypotension	2
<i>Surg detail</i>	Surgery type	2
<i>Comorbid</i>	Thrombocytopenia	2
<i>Lab value</i>	Troponin I	2
<i>Surg detail</i>	Urgency status of surgery: elective	2
<i>Surg detail</i>	urgent, emerg or emerg salvAge	2
<i>Lab value</i>	Uric acid	2
<i>Lab value</i>	WBC	2
<i>Medication</i>	Antidiabetic medications	New
<i>Medication</i>	steroids	New
<i>Medication</i>	Anticoagulants	New
<i>Medication</i>	Vasodilators	New
<i>Medication</i>	Lipid lowering drugs	New
<i>Comorbid</i>	Respiratory failure	New
<i>Medication</i>	Use of nephrotoxic antibiotic (vancomycin, aminoglycoside)	New
<i>Medication</i>	Antiplatelet agents	New

Figure S1. CONSORT DIAGRAM

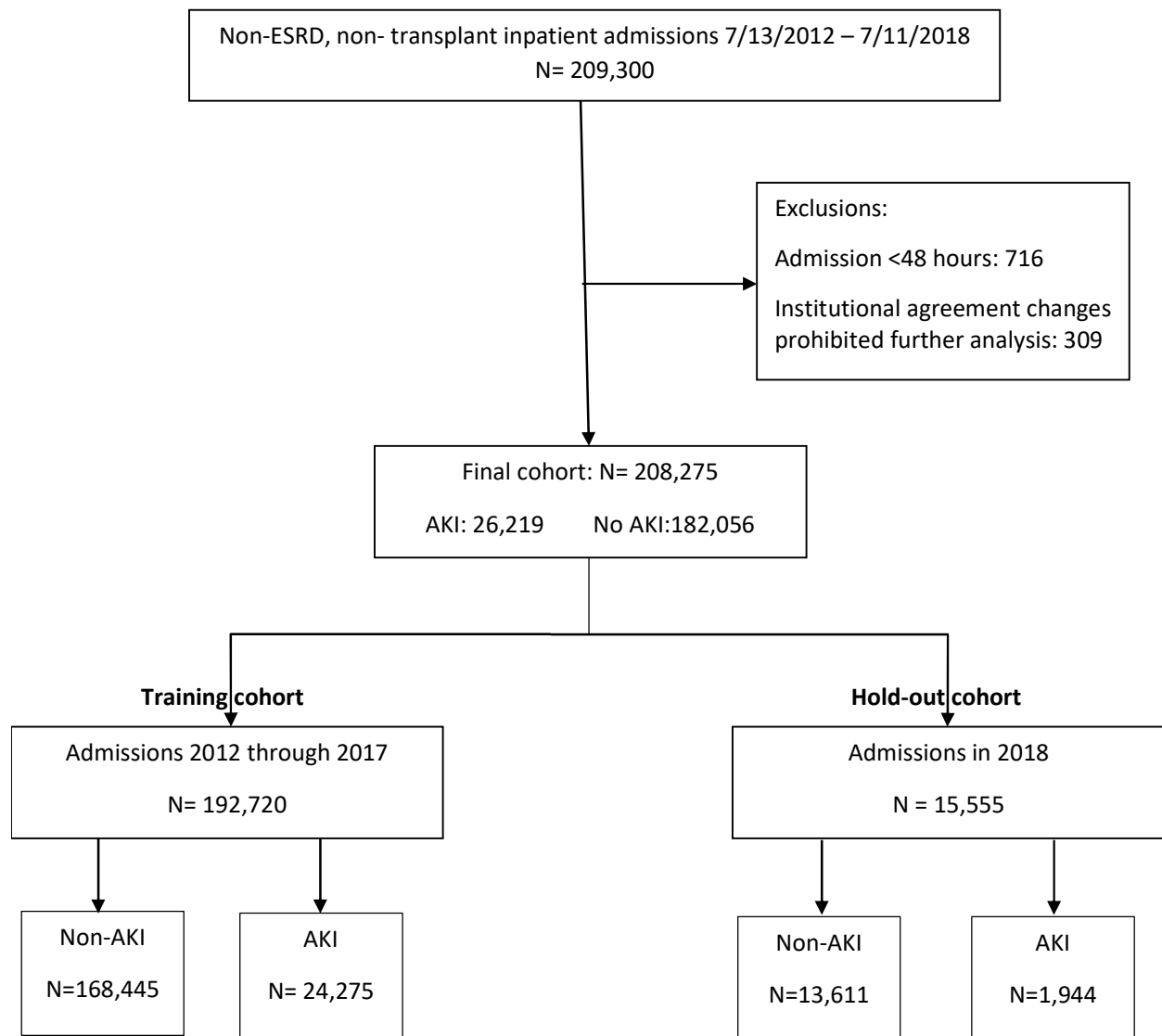


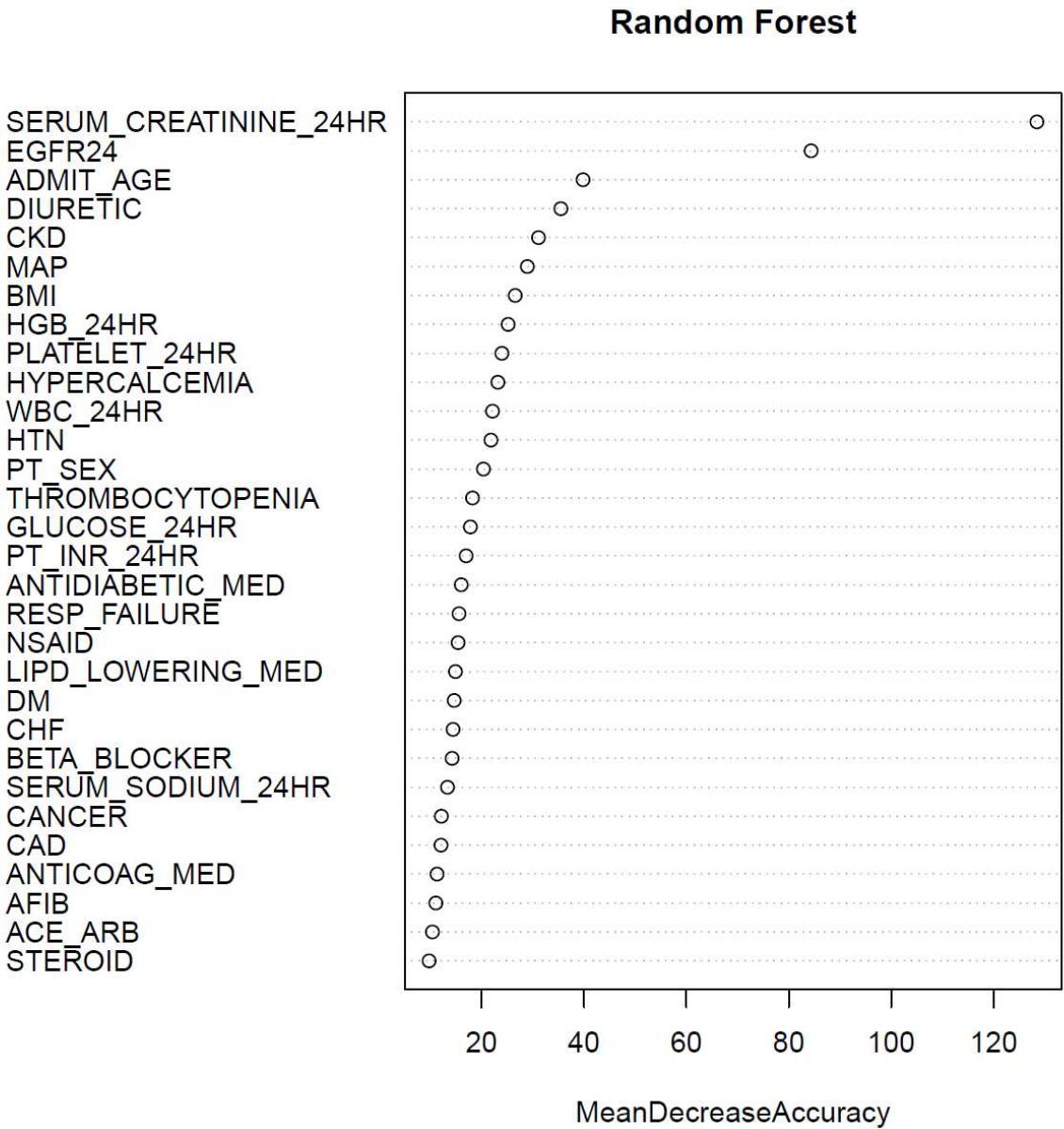
Table S2. Baseline and clinical characteristics in training and temporal validation cohort

	Training			Validation		
	AKI	No AKI	p-value	AKI	NoAKI	p-value
Total, n (%)	24275 (12.60)	168445 (87.40)		1944 (12.50)	13611 (87.50)	
Age, mean (SD)	70.07 (15.55)	63.19 (18.98)	<0.001	70.55 (15.25)	64.01 (18.92)	<0.001
Sex, n (%)	12658 (52.1)	73081 (43.4)	<0.001	1023 (52.6)	5825 (42.8)	<0.001
BMI, mean (SD)	31.37 (8.70)	30.49 (8.24)	0.004	31.43 (8.82)	30.77 (8.51)	<0.001
BSA, mean (SD)	1.97 (0.29)	1.93 (0.28)	<0.001	1.96 (0.30)	1.93 (0.29)	<0.001
MAP, mean (SD)	85.26 (15.40)	88.04 (12.78)	<0.001	85.30 (14.34)	87.92 (12.55)	<0.001
Smoke Status, n (%)			<0.001			<0.001
Former Smoker	11779 (48.5)	69105 (41.0)		933 (48.0)	5533 (40.7)	
Never Smoker	9224 (38.0)	65908 (39.1)		722 (37.1)	5466 (40.2)	
Smoker	3085 (12.7)	32496 (19.3)		274 (14.1)	2546 (18.7)	
Comorbidities, n (%)						
Atrial fibrillation	6364 (26.2)	26584 (15.8)	<0.001	364 (18.7)	1583 (11.6)	<0.001
Arrhythmia	3349 (13.8)	15934 (9.5)	<0.001	203 (10.4)	901 (6.6)	<0.001
Asthma	2111 (8.7)	18552 (11.0)	0.185	138 (7.1)	1088 (8.0)	<0.001
Coronary artery disease	8422 (34.7)	37906 (22.5)	<0.001	499 (25.7)	2102 (15.4)	<0.001
Cancer	3804 (15.7)	21900 (13.0)	0.004	160 (8.2)	877 (6.4)	<0.001
Congestive Heart fAilure	8542 (35.2)	27966 (16.6)	<0.001	483 (24.8)	1668 (12.3)	<0.001
Chronic Kidney Disease	9505 (39.2)	29860 (17.7)	<0.001	535 (27.5)	1633 (12.0)	<0.001
Obstructive Lung Disease	5306 (21.9)	29821 (17.7)	<0.001	323 (16.6)	1785 (13.1)	<0.001
Diabetes Mellitus	10318 (42.5)	44627 (26.5)	<0.001	637 (32.8)	2481 (18.2)	<0.001
Gastrointestinal Bleed	2845 (11.7)	13834 (8.2)	<0.001	156 (8.0)	802 (5.9)	<0.001
Hypertension	16341 (67.3)	86953 (51.6)	<0.001	911 (46.9)	4626 (34.0)	<0.001
Hypercalcemia	18664 (76.9)	127114 (75.5)	0.003	1501 (77.2)	10074 (74.0)	<0.001
Myocardial infarction	2426 (10.0)	9420 (5.6)	<0.001	138 (7.1)	603 (4.4)	<0.001
Vascular disease	3820 (15.7)	16212 (9.6)	<0.001	217 (11.2)	946 (7.0)	<0.001
Recurrent urine infection	4514 (18.6)	21393 (12.7)	<0.001	426 (21.9)	2081 (15.3)	<0.001

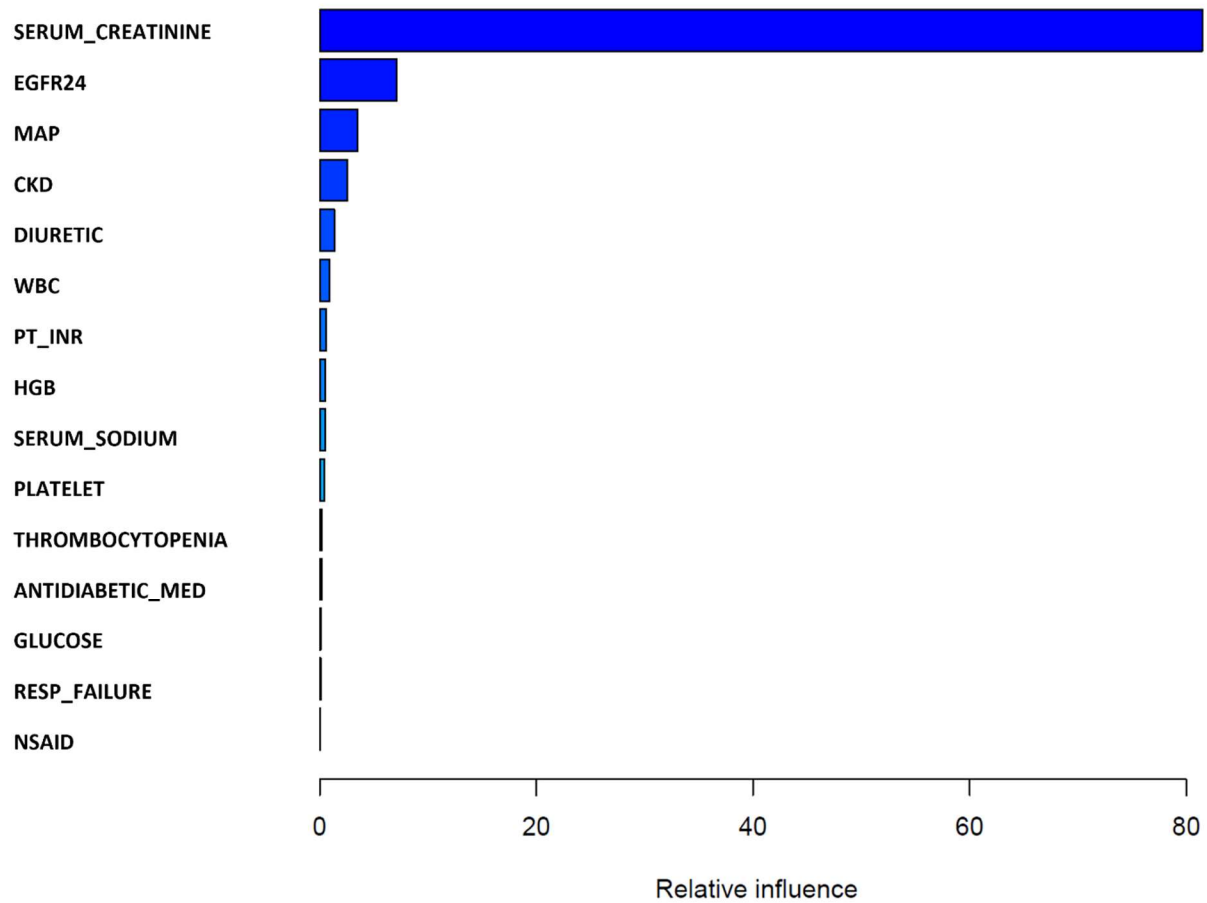
Respiratory failure	3502 (14.4)	15504 (9.2)	<0.001	225 (11.6)	1199 (8.8)	<0.001
Thrombocytopenia	17009 (70.1)	120633 (71.6)	0.745	1367 (70.3)	9518 (69.9)	<0.001
Heart Valve disease	3207 (13.2)	14025 (8.3)	<0.001	180 (9.3)	748 (5.5)	<0.001
Angina	7824 (32.2)	35918 (21.3)	<0.001	622 (32.0)	2932 (21.5)	<0.001
Medication, n (%)						
ACE inhibitor/ Angiotensin Blocker	6611 (27.2)	40611 (24.1)	0.003	535 (27.5)	3317 (24.4)	<0.001
Anticoagulants	8887 (36.6)	54878 (32.6)	<0.001	756 (38.9)	4310 (31.7)	<0.001
Antidiabetic medication	10497 (43.2)	45444 (27.0)	<0.001	883 (45.4)	3814 (28.0)	<0.001
Beta Blocker	14425 (59.4)	74341 (44.1)	<0.001	1114 (57.3)	6048 (44.4)	<0.001
Calcium Channel Blocker	6313 (26.0)	30547 (18.1)	<0.001	574 (29.5)	2943 (21.6)	<0.001
Diuretic	13198 (54.4)	50297 (29.9)	<0.001	1079 (55.5)	4210 (30.9)	<0.001
Lipd Lowering Drugs	11475 (47.3)	65743 (39.0)	<0.001	940 (48.4)	5569 (40.9)	<0.001
Nephrotoxic Antibiotic	2943 (12.1)	16436 (9.8)	0.712	250 (12.9)	1706 (12.5)	<0.001
Nonsteroidal analgesics	3225 (13.3)	43978 (26.1)	<0.001	288 (14.8)	3699 (27.2)	<0.001
Steroid	4528 (18.7)	32889 (19.5)	0.887	421 (21.7)	2971 (21.8)	0.001
Vasodilator	2672 (11.0)	9971 (5.9)	<0.001	225 (11.6)	1041 (7.6)	<0.001
Lab Measurements within 24-Hour, mean (SD)						
Serum Albumin, g/dL	3.22 (0.65)	3.55 (0.61)	<0.001	3.20 (0.62)	3.51 (0.59)	<0.001
Total Bilirubin mg/dL	1.23 (2.70)	0.80 (1.36)	<0.001	1.06 (2.66)	0.69 (1.10)	<0.001
Blood Urea Nitrogen, mg/dL	40.79 (25.35)	19.16 (12.19)	<0.001	42.45 (26.91)	19.54 (12.91)	<0.001
Serm Calcium, mg/dL	8.56 (0.82)	8.70 (0.67)	<0.001	8.52 (0.77)	8.67 (0.65)	<0.001
Serum Creatinine, mg/dL	2.09 (1.35)	0.98 (0.45)	<0.001	2.10 (1.36)	0.98 (0.45)	<0.001
Glucose,mg/dL	139.75 (63.14)	130.89 (53.31)	<0.001	143.20 (65.01)	134.16 (56.69)	<0.001
Hemoglobin, g/dL	10.57 (2.10)	11.48 (2.07)	<0.001	10.47 (2.17)	11.44 (2.10)	<0.001
Platelet 1000/mL	202.35 (100.04)	216.90 (94.00)	<0.001	210.67 (104.39)	221.41 (94.75)	<0.001
Potassium, meq/L	4.27 (0.66)	4.07 (0.50)	<0.001	4.31 (0.69)	4.09 (0.50)	<0.001
PT/INR	1.75 (1.07)	1.47 (0.77)	<0.001	1.68 (0.96)	1.41 (0.72)	<0.001
Serum Sodium, meq/L	137.96 (5.14)	138.22 (4.03)	0.241	138.78 (5.15)	138.90 (4.05)	<0.001

Leukocytes, 1000/mL	11.23 (10.98)	9.94 (6.61)	<0.001	10.70 (7.98)	9.83 (5.38)	<0.001
Estimated GFR, mL/min/1.73m²	40.99 (27.07)	75.46 (28.81)	<0.001	40.24 (26.63)	74.47 (28.52)	<0.001

Figure S2. Top 15 features: relative importance in the 3 models



Gradient Boosted Model



Top 15 features and coefficient from LASSO regression

	Coefficient	OR
Serum creatinine	0.68	1.98
eGFR	-0.64	0.53
CKD	-0.59	0.55
Diuretic use	0.41	1.50
BUN	0.31	1.37
NSAID use	-0.21	0.81
Age	-0.20	0.82
Mean Arterial Pressure	-0.18	0.83

Nephrotoxic antibiotics	0.18	1.19
Hypercalcemia	-0.17	0.85
Calcium blocker	0.16	1.17
Thrombocytopenia	-0.16	0.85
Steroid use	-0.16	0.86
Serum albumin	-0.15	0.86
Cancer	0.14	1.15

Table S3. TRIPOD Checklist: Prediction Model Development

Section/Topic		Checklist Item	Page
Title and abstract			
Title	1	Identify the study as developing and/or validating a multivariable prediction model, the target population, and the outcome to be predicted.	1
Abstract	2	Provide a summary of objectives, study design, setting, participants, sample size, predictors, outcome, statistical analysis, results, and conclusions.	1
Introduction			
Background and objectives	3a	Explain the medical context (including whether diagnostic or prognostic) and rationale for developing or validating the multivariable prediction model, including references to existing models.	1-2
	3b	Specify the objectives, including whether the study describes the development or validation of the model or both.	2-4
Methods			
Source of data	4a	Describe the study design or source of data (e.g., randomized trial, cohort, or registry data), separately for the development and validation data sets, if applicable.	2
	4b	Specify the key study dates, including start of accrual; end of accrual; and, if applicable, end of follow-up.	2
Participants	5a	Specify key elements of the study setting (e.g., primary care, secondary care, general population) including number and location of centres.	2
	5b	Describe eligibility criteria for participants.	2
	5c	Give details of treatments received, if relevant.	N/A
Outcome	6a	Clearly define the outcome that is predicted by the prediction model, including how and when assessed.	2-3
	6b	Report any actions to blind assessment of the outcome to be predicted.	N/A
Predictors	7a	Clearly define all predictors used in developing or validating the multivariable prediction model, including how and when they were measured.	3-4
	7b	Report any actions to blind assessment of predictors for the outcome and other predictors.	N/A
Sample size	8	Explain how the study size was arrived at.	4
Missing data	9	Describe how missing data were handled (e.g., complete-case analysis, single imputation, multiple imputation) with details of any imputation method.	3-4
Statistical analysis methods	10a	Describe how predictors were handled in the analyses.	3-4
	10b	Specify type of model, all model-building procedures (including any predictor selection), and method for internal validation.	4
	10d	Specify all measures used to assess model performance and, if relevant, to compare multiple models.	4
Risk groups	11	Provide details on how risk groups were created, if done.	N/A
Results			
Participants	13a	Describe the flow of participants through the study, including the number of participants with and without the outcome and, if applicable, a summary of the follow-up time. A diagram may be helpful.	4-5
	13b	Describe the characteristics of the participants (basic demographics, clinical features, available predictors), including the number of participants with missing data for predictors and outcome.	5-6
Model development	14a	Specify the number of participants and outcome events in each analysis.	4-5
	14b	If done, report the unadjusted association between each candidate predictor and outcome.	Supp
Model specification	15a	Present the full prediction model to allow predictions for individuals (i.e., all regression coefficients, and model intercept or baseline survival at a given time point).	6-8
	15b	Explain how to use the prediction model.	8-9
Model performance	16	Report performance measures (with CIs) for the prediction model.	6-7
Discussion			
Limitations	18	Discuss any limitations of the study (such as nonrepresentative sample, few events per predictor, missing data).	9

Interpretation	19b	Give an overall interpretation of the results, considering objectives, limitations, and results from similar studies, and other relevant evidence.	9-10
Implications	20	Discuss the potential clinical use of the model and implications for future research.	9-10
Other information			
Supplementary information	21	Provide information about the availability of supplementary resources, such as study protocol, Web calculator, and data sets.	10
Funding	22	Give the source of funding and the role of the funders for the present study.	11

Table S4. Baseline and clinical characteristics in training and temporal validation cohort

Feature	Missing %
Body mass index	19.00%
Body Surface Area	19.00%
Mean Arterial Pressure	0.42%
Serum albumin	47.68%
Total Bilirubin	49.13%
Blood Urea Nitrogen	13.31%
Serum Calcium	13.26%
Serum creatinine	16.32%
Blood Glucose	12.96%
Hemoglobin	8.50%
Platelet count	10.67%
Serum Potassium	12.59%
Prothrombin time	46.10%
Serum sodium	12.89%
White Blood Cell	10.69%
eGFR	16.32%