Supplementary Materials

Table S1. Baseline characteristic of all features

Variable names	Total(Six-month re-admission)		*p*-value
	non-readmission(N=1229)	re-admission (N=773)	
destination discharge			<0.001
dead	9 (0.7%)	0 (0%)	
Healthcare Facility	258 (21%)	180 (23.3%)	
Home	810 (65.9%)	533 (69%)	
Unknown	152 (12.4%)	60 (7.8%)	
admission ward			0.014
Cardiology	926 (75.3%)	618 (79.9%)	
General Ward	162 (13.2%)	100 (12.9%)	
ICU	11 (0.9%)	4 (0.5%)	
others	130 (10.6%)	51 (6.6%)	
admission way			1
Emergency	583 (47.4%)	367 (47.5%)	
Nonemergency	646 (52.6%)	406 (52.5%)	
occupation			<0.001
Famer	156 (12.7%)	57 (7.4%)	
officer	8 (0.7%)	10 (1.3%)	
Urban Resident	1000 (81.4%)	665 (86%)	
worker	14 (1.1%)	3 (0.4%)	
others	51 (4.1%)	38 (4.9%)	
discharge department			0.047
Cardiology	1035 (84.2%)	665 (86%)	
General Ward	149 (12.1%)	89 (11.5%)	
ICU	12 (1%)	0 (0%)	
others	33 (2.7%)	19 (2.5%)	
visit times			0.012
1	1147 (93.3%)	708 (91.6%)	
2	73 (5.9%)	47 (6.1%)	
3	8 (0.7%)	11 (1.4%)	
4	0 (0%)	6 (0.8%)	
5	1 (0.1%)	1 (0.1%)	
gender			0.363
male	506 (41.2%)	335 (43.3%)	
female	723 (58.8%)	438 (56.7%)	
body temperature/°C	36.4(36.2,36.5)	36.3(36.2,36.5)	0.055
pulse/(beats/min)	84(71,100)	81(70,96)	0.035
respiration/(breaths/min)	19(18,20)	19(18,19)	0.500
systolic blood pressure/mmHg	130(118,150)	128(10,144)	<0.001
Kdiastolic blood pressure/mmHg	78(68,86)	74(64,84)	0.009
map/mmHg	95.33(84,106)	92.67(82,103.33)	<0.001
weight /Kg	50(45,60)	50(45,60)	0.299
height/m	1.56(1.50,1.62)	1.56(1.50,1.62)	0.792
BMI/(kg/m^2)	20.83(18.63,24.44)	20.40(18.37,23.44)	0.098
type of heart failure			<0.001
Left or right	378 (30.8%)	148 (19.1%)	
whole	851 (69.2%)	625 (80.9%)	
NYHA cardiac function classification			<0.001
2	250 (20.3%)	103 (13.3%)	
3	642 (52.2%)	395 (51.1%)	
4	337 (27.4%)	275 (35.6%)	
Killip grade			0.216
1	328 (26.7%)	199 (25.7%)	
2	618 (50.3%)	409 (52.9%)	
3	253 (20.6%)	138 (17.9%)	
4	30 (2.4%)	27 (3.5%)	
Myocardial infarction			0.552
0	1138 (92.6%)	722 (93.4%)	

1	91 (7.4%)	51 (6.6%)	
congestive heart failure			0.467
0	79 (6.4%)	57 (7.4%)	
1	1150 (93.6%)	716 (92.6%)	
peripheral vascular disease			0.852
0	1169 (95.1%)	733 (94.8%)	
1	60 (4.9%)	40 (5.2%)	
cerebrovascular disease			0.865
0	1139 (92.7%)	714 (92.4%)	
1	90 (7.3%)	59 (7.6%)	
dementia			0.010
0	1172 (95.4%)	715 (92.5%)	
1	57 (4.6%)	58 (7.5%)	
chronic obstructive pulmonary disease			0.991
0	1086 (88.4%)	684 (88.5%)	
1	143 (11.6%)	89 (11.5%)	
connective tissue disease			0.283
0	1225 (99.7%)	773 (100%)	
1	4 (0.3%)	0 (0%)	
peptic ulcer disease			0.201
0	1206 (98.1%)	751 (97.2%)	
1	23 (1.9%)	22 (2.8%)	
diabetes			<0.001
0	978 (79.6%)	560 (72.4%)	
1	251 (20.4%)	213 (27.6%)	
Moderate to severe chronic kidney disease			<0.001
0	977 (79.5%)	554 (71.7%)	
1	252 (20.5%)	219 (28.3%)	
hemiplegia			1
0	1222 (99.4%)	768 (99.4%)	
1	7 (0.6%)	5 (0.6%)	
solid tumor			0.853
0	1204 (98%)	759 (98.2%)	
1	25 (2%)	14 (1.8%)	
liver disease			0.788
0	1177 (95.8%)	743 (96.1%)	
1	52 (4.2%)	30 (3.9%)	
AIDS			0.283
0	1225 (99.7%)	773 (100%)	
1	4 (0.3%)	0 (0%)	
CCI score			<0.001
0	31 (2.5%)	25 (3.2%)	
1	501 (40.8%)	269 (34.8%)	
2	439 (35.7%)	262 (33.9%)	
3	211 (17.2%)	156 (20.2%)	
4	41 (3.3%)	51 (6.6%)	
5	6 (0.5%)	9 (1.2%)	
6	0 (0%)	1 (0.1%)	
type II respiratory failure			0.411
0	1155 (94%)	734 (95%)	
1	74 (6%)	39 (5%)	
consciousness			0.070
clear	1203 (97.9%)	766 (99.1%)	
Responsive to Pain	3 (0.2%)	1 (0.1%)	
Responsive to Sound	13 (1.1%)	6 (0.8%)	
Nonresponsive	10 (0.8%)	0 (0%)	
Eye-opening			0.064
1	12 (1%)	1 (0.1%)	
2	3 (0.2%)	0 (0%)	

3	14 (1.1%)	10 (1.3%)	
4	1200 (97.6%)	762 (98.6%)	
verbal response			0.072
1	12 (1%)	1 (0.1%)	
2	7 (0.6%)	1 (0.1%)	
3	9 (0.7%)	9 (1.2%)	
4	2 (0.2%)	1 (0.1%)	
5	1199 (97.6%)	761 (98.4%)	
movement			0.321
1	17 (1.4%)	4 (0.5%)	
2	1 (0.1%)	0 (0%)	
3	2 (0.2%)	0 (0%)	
4	1 (0.1%)	1 (0.1%)	
5	12 (1%)	10 (1.3%)	
6	1196 (97.3%)	758 (98.1%)	
respiratory support			0.422
None	1200 (97.6%)	760 (98.3%)	
IMV	16 (1.3%)	9 (1.2%)	
NIMV	13 (1.1%)	4 (0.5%)	
oxygen inhalation			0.417
Ambient Air	63 (5.1%)	47 (6.1%)	
Oxygen Therapy	1166 (94.9%)	726 (93.9%)	
fio2/%	33(33,33)	33(33,33)	0.004
acute renal failure			0.875
0	1224 (99.6%)	771 (99.7%)	
1	5 (0.4%)	2 (0.3%)1	
outcome during hospitalization			<0.001
Alive	1140 (92.8%)	745 (96.4%)	
Dead	10 (0.8%)	0 (0%)	
discharge against Order	79 (6.4%)	28 (3.6%)	
creatinine enzymatic method/(umol/l)	82.2(63.1,115.1)	93.9(69.7,131.0)	<0.001
urea/(mmol/l)	7.57(5.71,10.92)	8.6(6.24,12.33)	<0.001
uric acid/(mmol/l)	0.446(0.353,0.559)	0.477(0.377,0.604)	<0.001
glomerular filtration rate/(mL/min/1.73 m^2)	69.78(45.87,93.65)	57.72(39.39,82.29)	<0.001
cystatin/(mg/L)	1.48(1.18,2.05)	1.64(1.27,2.29)	<0.001
white blood cell/(*10^9/L)	6.52(5.09,8.73)	6.4(5.1,8.35)	0.305
monocyte ratio/%	0.07(0.05,0.08)	0.07(0.05,0.08)	0.265
monocyte count/(*10^9/L)	0.42(0.32,0.589)	0.42(0.32,0.56)	0.586
red blood cell/(*10^12/L)	3.93(3.47,4.35)	3.83(3.40,4.21)	0.001
coefficient of variation of red blood cell distribution width/%	14.4(13.5,15.5)	14.4(13.7,15.8)	0.021
standard deviation of red blood cell distribution width/fL	47.6(44.9,50.9)	48.1(45.6,52.0)	0.002
mean corpuscular volume/fL	93.1(88.9,96.5)	93.5(88.8,97.7)	0.049
hematocrit/%	0.362(0.318,0.401)	0.355(0.313,0.391)	0.010
lymphocyte count/(*10^9/L)	0.94(0.61,1.29)	0.93(0.66,1.29)	0.259
mean hemoglobin volume/pg	30.5(28.7,31.8)	30.7(29,32.2)	0.043
mean hemoglobin concentration/(g/L)	326(319,333)	326(318,334)	0.866
mean platelet volume//fL	12.2(10.9,13.3)	12.1(10.9,13.1)	0.137
basophil ratio	0.004(0.002,0.006)	0.004(0.003,0.006)	<0.001
basophil count/(*10^9/L)	0.02(0.02,0.04)	0.03(0.02,0.04)	0.011
eosinophil ratio	0.009(0.002.0.022)	0.011(0.003,0.024)	0.027
eosinophil count/(*10^9/L)	0.06(0.02,0.13)	0.06(0.02,0.15)	0.022
hemoglobin/(g/L)	118(108,133)	116(100,129.5)	0.026
platelet count/(*10^9/L)	138(102,178)	132(99,172)	0.062
platelet distribution width/fL	16.3(16,16.6)	16.3(16,16.6)	0.272
platelet hematocrit/%	0.17(0.13,0.21)	0.16(0.13,0.20)	0.027
neutrophil ratio	0.76(0.69,0.83)	0.75(0.67,0.81)	0.012

neutrophil count/(*10^9/L)	4.91(3.63,6.98)	4.81(3.54,6.48)	0.144
D dimer/(mg/l)	1.28(0.83,2.28)	0.17(0.79,2.02)	0.004
international normalized ratio	1.20(1.12,1.34)	1.23(1.13,1.38)	0.002
activated partial thromboplastin time/s	33.8(30.6,37.7)	34.6(31.4,38.6)	0.003
thrombin time/s	17.2(16.3,17.9)	17.2(16.3,17.9)	0.79
prothrombin activity/%	69.5(58.6,78.8)	67.2(53.8,77.4)	0.003
prothrombin time ratio	0.21 1.12,1.34(	1.23(1.14,1.38)	0.003
fibrinogen/(g/L)	3.04(2.48,3.7)	3.08(2.51,3.69)	0.665
high sensitivity troponin/(pg/mL)	0.05(0.02,0.11)	0.063(0.029,0.121)	<0.001
carbon dioxide binding capacity/ (mmol/L)	23.9(21.1,26.8)	23.9(20.6,26.6)	0.184
calcium/ (mmol/L)	2.28(2.17,2.39)	2.3(2.2,2.41)	0.004
potassium/ (mmol/L)	3.85(3.5,4.3)	3.91(3.57,4.39)	0.003
chloride/ (mmol/L)	102.8(99,106.1)	102.2(98.2,105.7)	0.032
sodium/ (mmol/L)	139.2(136.3,141.7)	138.6(135.2,141.0)	<0.001
creatine kinase isoenzyme to creatine kinase	0.17(0.12,0.25)	0.17(0.12,0.26)	0.277
hydroxybutyrate dehydrogenase to lactate dehydrogenase	0.83(0.78,0.88)	0.82(0.77,0.86)	0.076
hydroxybutyrate dehydrogenase/(U/L)	190(163,227)	188(163,225)	0.393
glutamic oxaloacetic transaminase /(IU/L)	26(20,39)	26(20,37)	0.330
creatine kinase/(IU/L)	94(66.27,136)	93(66,132)	0.482
creatine kinase isoenzyme/(IU/L)	16.25(12.4,21.2)	16.1(12.3,21.2)	0.787
lactate dehydrogenase/(IU/L)	229(197,278)	228(196,275)	0.808
brain natriuretic peptide/(pg/ml)	729.29(300.4,1685.73)	870.85(319.42,1883.65)	0.11
nucleotidase/(/U/L)	3.2(2.3,4.8)	3.22(2.4,4.84)	0.377
fucosidase/(U/L)	18.6(15.9,21.7)	18.66(16,22.2)	0.455
albumin/(g/L)	36.7(33.4,39.6)	37(33.9,40)	0.069
white globulin ratio/(U/L)	1.3(1.1,1.5)	1.4(1.2,1.5)	0.071
glutamyl transpeptidase/(U/L)	38.64(22,71)	41(25,74)	0.252
glutamic pyruvic transaminase/(U/L)	22(14,37)	20(13,33)	0.010
indirect bilirubin/(umol/L)	11.6(7.9,16.7)	12.1(8.00,17.3)	0.172
alkaline phosphatase(umol/L)	80(64,101)	79(65,100)	0.815
globulin/(g/L)	27.9(24.73,31.4)	27.8(25,30.9)	0.358
direct bilirubin(umol/L)	6.4(4.0,10.2)	6.9(4.4,10.6)	0.048
total bilirubin(umol/L)	18.1(12.2,27.1)	19.2(12.7,28.3)	0.102
total bile acid(umol/L)	5.3(3.1,8.4)	5.17(3.1,8.8)	0.826
total protein/(g/L)	64.6(60.2,69.2)	64.99(30.5,69.3)	0.536
cholesterol/(mmol/L)	3.6(3.1,4.3)	3.51(2.93,4.17)	<0.001
low density lipoprotein cholesterol	1.8(1.4,2.3)	1.74(1.3,2.17)	0.004
triglyceride/(mmol/L)	0.99(0.75,1.31)	0.94(0.71,1.31)	0.071
high density lipoprotein cholesterol/(umol/L)	1.09(0.88,1.29)	1.07(0.81,1.27)	0.331
GCS	15(15,15)	15(15,15)	0.078
discharge day	7(5,10)	8(6,11)	<0.001
age cat			0.098
(21-29]	1 (0.1%)	3 (0.4%)	
(29-39]	11 (0.9%)	1 (0.1%)	
(39-49]	38 (3.1%)	18 (2.3%)	
(49-59]	66 (5.4%)	40 (5.2%)	
(59-69]	236 (19.2%)	130 (16.8%)	
(69-79]	419 (34.1%)	295 (38.2%)	
(79-89]	399 (32.5%)	244 (31.6%)	
(89-110]	59 (4.8%)	42 (5.4%)	

*The Kruskal-Wallis and x^2 tests were used to compare baseline characteristics of six-month re-admission and six-month non-read-mission. The Kruskal-Wallis test was used for non-normal continuous variables and the x^2 test was used for categorical variables.

Table S2. The criteria or statistical parameters for the three variable screening methods

Variable selection methods	The criteria or statistical parameters
a combination of single-factor regression and multi-factor regression was used to screen the study variables	Variables with $p<0.05$ were considered statistically significant. The BH method was used to correct for p values
LASSO regression	$\lambda = 0.02937$
Random forest	N=500

Table S3. The statistical parameters and *p-values* of the 12 variables

Variable	β	p-value	Variable	β	p-value
admission ward(cardiology)			diabetes(no)		
admission ward(general Ward)	0.2096	0.254	diabetes(yes)	0.4336	0.001
admission ward(ICU)	-0.9988	0.358	platelet count	-0.0007	0.7504
admission ward(others)	-0.4662	0.032	basophil count	7.6110	0.0021
D-dimer	-0.1061	<0.001	NYHA cardiac function classification (class 2)		
discharge day	0.0224	<0.001	NYHA cardiac function classification (class 3)	0.3733	0.0244
uric acid	0.0006	0.1168	NYHA cardiac function classification (class 4)	0.6151	<0.001
platelet hematocrit	-1.9210	0.4202	type of heart failure(left or right)		
glomerular filtration rate	-0.0024	0.2242	type of heart failure(whole)	0.5767	<0.001
mean hemoglobin volume	0.0416	0.0170			

Table S4. The criteria or statistical parameters for the six prediction models

Methods	A combination of single-factor regression and multi-factor regression				LASSO regression				Random forest			
	AUC (95%CI)	Accuracy	Sensitivity	Specificity	AUC (95%CI)	Accuracy	Sensitivity	Specificity	AUC (95%CI)	Accuracy	Sensitivity	Specificity
LR	0.634(0.599,0.646)	0.652	0.324	0.844	0.637(0.568,0.665)	0.667	0.333	0.863	0.634(0.441,0.797)	0.657	0.288	0.973
CART	0.544(0.270,0.818)	0.616	0.270	0.818	0.623(0.486,0.760)	0.659	0.486	0.760	0.573(0.365,0.781)	0.627	0.365	0.781
XGBoost	0.565(0.401,0.728)	0.607	0.401	0.728	0.547(0.419,0.675)	0.581	0.419	0.675	0.556(0.405,0.707)	0.596	0.405	0.707
NB	0.593(0.573,0.613)	0.587	0.613	0.573	0.603(0.562,0.644)	0.592	0.562	0.644	0.559(0.412,0.707)	0.521	0.707	0.412
SVM	0.564(0.203,0.926)	0.659	0.203	0.926	0.563(0.189,0.937)	0.661	0.189	0.937	0.547(0.203,0.892)	0.637	0.203	0.892
RF	0.580(0.356,0.805)	0.639	0.356	0.805	0.578(0.351,0.805)	0.637	0.351	0.805	0.564(0.329,0.799)	0.626	0.329	0.799

Table S5. The results of the three variable screening methods are used to construct the model separately.

prediction models	The criteria or statistical parameters
Logistic regression	Variables with $p<0.05$ were considered statistically significant.
CART	cp=0.01, $nsplit$=12
XGBoost	max_depth=6, eta=0.5
NB	$laplace$=0
SVM	$degree$=3, $cost$=1
RF	N=500

Table S6. Comparison of the predictive power of a 10-variable LR model with a 12-variable LR model.

Model names	AUC (95%CI)	Accuracy	Sensitivity(%)	Specificity(%)
10-variable LR model	0.634(0.599-0.646)	0.652	32.4	84.4
12-variable LR model	0.639(0.554-0.676)	0.657	32.4	85.2

Table S7. The results of the ROC analysis for individual clinical variables.

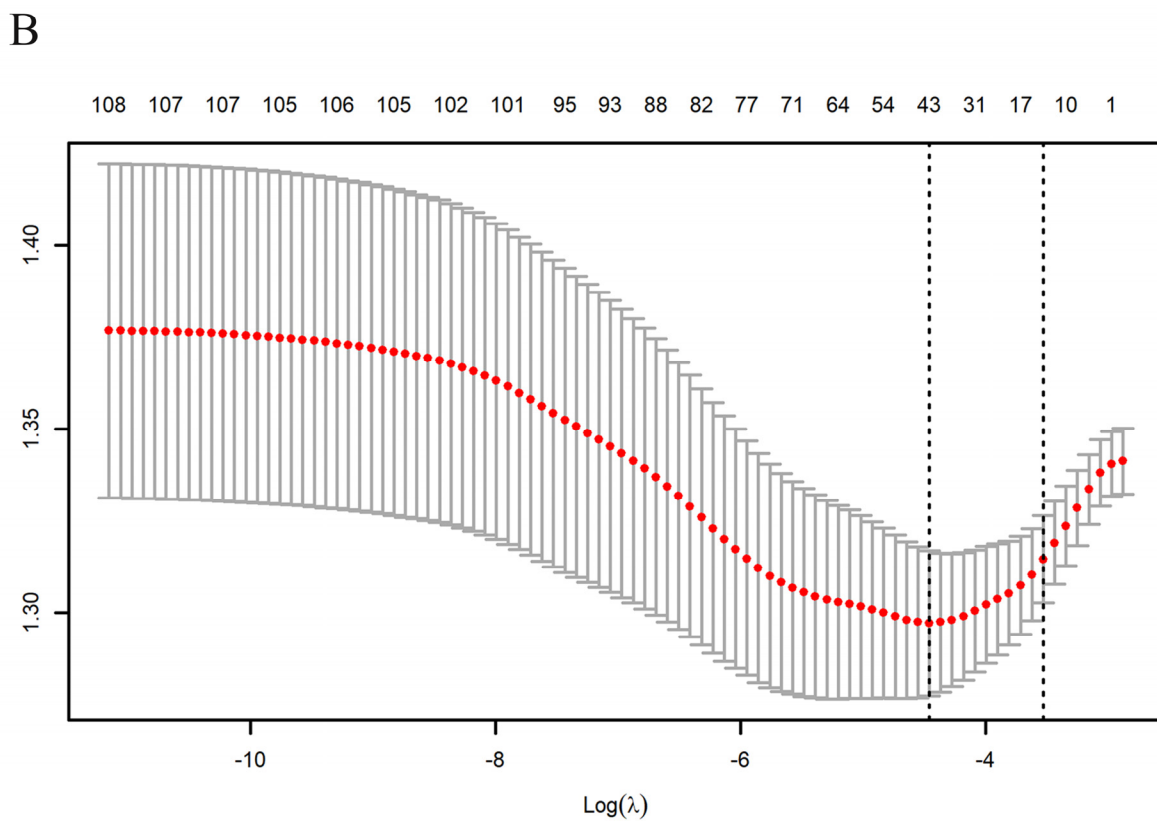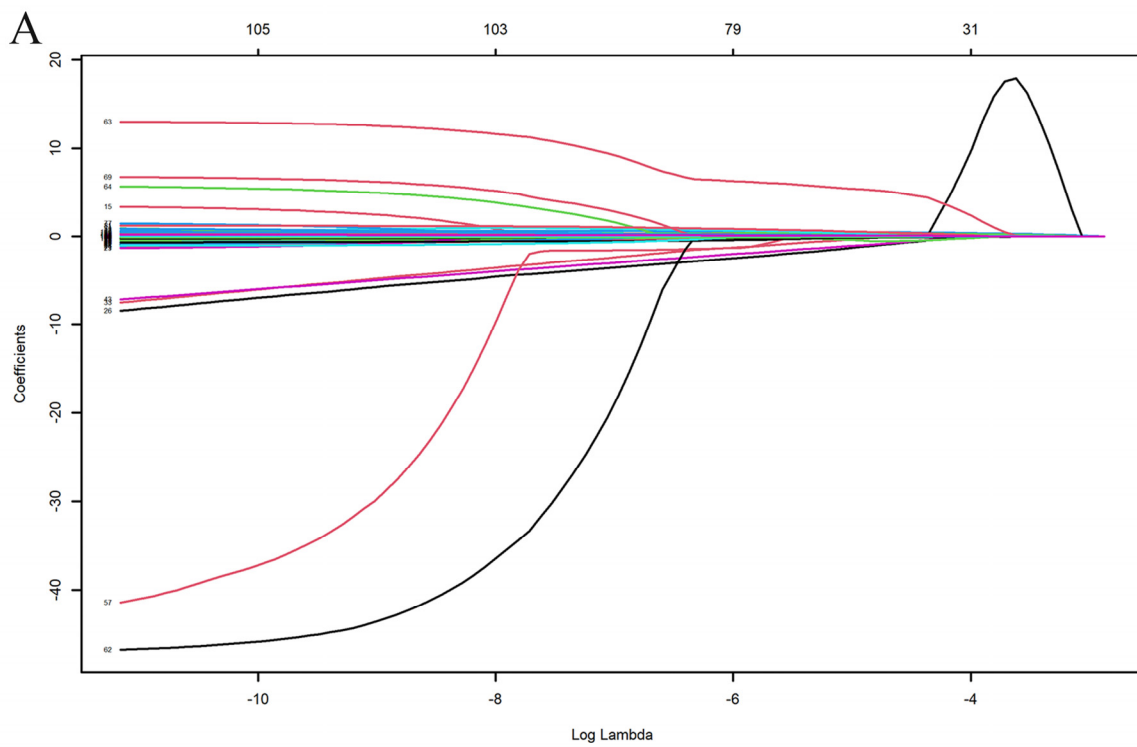| Variable names	AUC (95%CI)	Accuracy	Sensitivity(%)	Specificity(%)
admission word	0.490(0.106-0.919)	0.631	0	100
D-dimer	0.524(0.142-0.914)	0.631	0	100
discharge day	0.608(0.420,0.775)	0.632	4.50	97.6
uric acid	0.589(0.470,0.689)	0.629	1.80	98.7
platelet hematocrit	0.508(0.126,0.921)	0.631	0	100
mean hemoglobin volume	0.538(0.270,0.844)	0.631	0	100
basophil count	0.551(0.342,0.736)	0.632	3.6	98.15
NYHA cardiac function classification	0.564(0.369,0.731)	0.631	0	100
glomerular filtration rate	0.607(0.568,0.649)	0.631	0	100
platelet count	0.528(0.340,0.730)	0.631	0	100
type of heart failure	0.573(0.317,0.829)	0.631	0	100
diabetes	0.520(0.243,0.797)	0.631	0	100

Figure S1. (A)Variable selection by LASSO. As λ increases, the coefficients of some variables keep decreasing until they are zero. (B) Plot for LASSO coefficients. The left dotted line is the value of λ at the smallest mean square error, and the right dotted line is the value of λ one standard error away from the smallest mean square error.