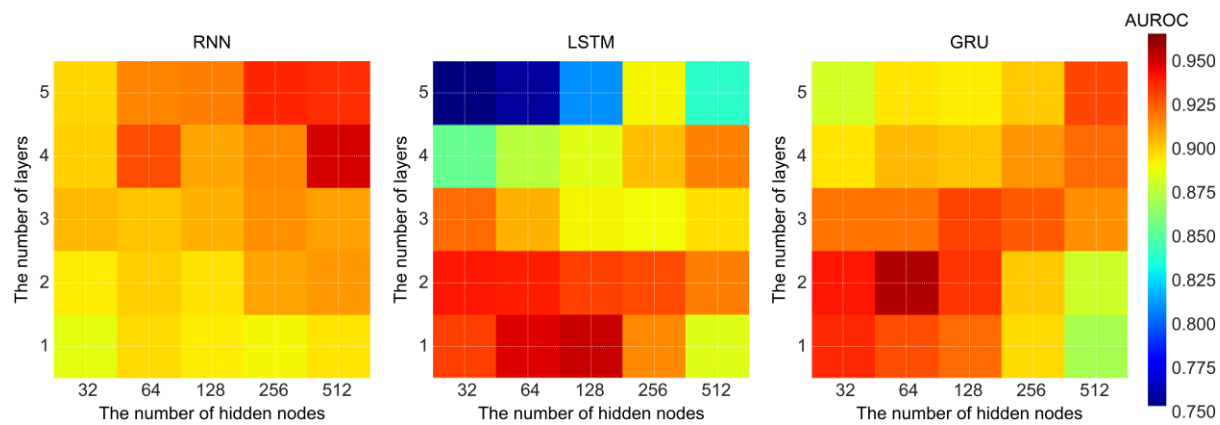




Supplementary Figure 1. Performance heatmaps of RNN-based models in the development process. GRU with two layers and 64 nodes was selected as the best model.

Supplementary Table 1. Performance for detecting CDI. All sensitivities are fixed to 0.9

	AUROC	P-value	AUPRC	Sensitivity	Specificity	Precision	F1-score
Internal validation							
Tree-based model							
Random forest	0.834 (0.791-0.877)	0.1493	0.049 (0.006-0.092)	0.904 (0.899-0.909)	0.454 (0.445-0.462)	0.012 (0.010-0.014)	0.023 (0.021-0.026)
GBM	0.853 (0.813-0.894)		0.070 (0.029-0.111)	0.904 (0.899-0.909)	0.553 (0.544-0.561)	0.014 (0.012-0.017)	0.028 (0.026-0.031)
RNN-based model							
Simple RNN	0.968 (0.957-0.979)	<0.0001	<u>0.165</u> <u>(0.154-0.176)</u>	0.904 (0.899-0.909)	0.904 (0.899-0.909)	0.064 (0.060-0.068)	0.119 (0.113-0.125)
LSTM	0.939 (0.918-0.961)	0.0001	0.118 (0.096-0.140)	0.904 (0.899-0.909)	0.852 (0.846-0.858)	0.042 (0.039-0.046)	0.081 (0.076-0.085)
GRU	<u>0.952</u> <u>(0.932-0.973)</u>	<0.0001	0.250 (0.229-0.270)	0.904 (0.899-0.909)	<u>0.873</u> <u>(0.867-0.879)</u>	<u>0.049</u> <u>(0.045-0.053)</u>	<u>0.093</u> <u>(0.088-0.098)</u>
Attention-based model							
Transformer	0.871 (0.837-0.904)	0.1053	0.074 (0.040-0.108)	0.904 (0.899-0.909)	0.588 (0.580-0.596)	0.016 (0.014-0.018)	0.031 (0.028-0.034)
RETAIN	0.746 (0.699-0.793)	0.0271	0.025 (0.000-0.072)	0.904 (0.899-0.909)	0.344 (0.336-0.352)	0.010 (0.008-0.012)	0.019 (0.017-0.022)
External validation							
Tree-based model							
Random forest	0.833 (0.818-0.847)	<0.0001	0.086 (0.071-0.100)	0.900 (0.897-0.904)	0.582 (0.576-0.587)	0.042 (0.040-0.044)	0.080 (0.077-0.083)
GBM	0.860 (0.847-0.873)		0.118 (0.105-0.131)	0.900 (0.897-0.904)	0.636 (0.631-0.641)	0.048 (0.046-0.050)	0.091 (0.088-0.094)
RNN-based model							
Simple RNN	<u>0.958</u> <u>(0.953-0.963)</u>	<0.0001	0.241 (0.237-0.246)	0.900 (0.897-0.904)	<u>0.897</u> <u>(0.894-0.901)</u>	<u>0.151</u> <u>(0.147-0.155)</u>	<u>0.259</u> <u>(0.254-0.264)</u>
LSTM	0.940 (0.934-0.947)	<0.0001	<u>0.271</u> <u>(0.264-0.277)</u>	0.900 (0.897-0.904)	0.842 (0.838-0.846)	0.104 (0.100-0.107)	0.186 (0.182-0.190)
GRU	0.972 (0.968-0.975)	<0.0001	0.535 (0.531-0.539)	0.900 (0.897-0.904)	0.910 (0.907-0.913)	0.169 (0.165-0.173)	0.284 (0.279-0.289)
Attention-based model							
Transformer	0.871 (0.858-0.883)	<0.0001	0.179 (0.166-0.191)	0.900 (0.897-0.904)	0.655 (0.649-0.660)	0.050 (0.048-0.053)	0.095 (0.092-0.099)
RETAIN	0.755 (0.735-0.774)	<0.0001	0.091 (0.071-0.110)	0.900 (0.897-0.904)	0.377 (0.372-0.382)	0.029 (0.027-0.030)	0.055 (0.053-0.058)

*Bold indicates the best and underline indicates the second best.

*P-values were calculated using the DeLong method.

*Abbreviations: AUROC=area under the receiver operating characteristic curve, AUPRC=area under the precision-recall curve, GBM=gradient boosting machine, RNN=recurrent neural network, LSTM=long short-term memory, GRU=gated recurrent unit

Supplementary Table 2. Performance for detecting CDI. All sensitivities are fixed to 0.95

	AUROC	P-value	AUPRC	Sensitivity	Specificity	Precision	F1-score
Internal validation							
Tree-based model							
Random forest	0.834 (0.791-0.877)	0.1493	0.049 (0.006-0.092)	0.957 (0.954-0.961)	0.293 (0.285-0.300)	0.010 (0.008-0.011)	0.019 (0.017-0.022)
GBM	0.853 (0.813-0.894)		0.070 (0.029-0.111)	0.957 (0.954-0.961)	0.452 (0.444-0.461)	0.012 (0.011-0.014)	0.025 (0.022-0.027)
RNN-based model							
Simple RNN	0.968 (0.957-0.979)	<0.0001	<u>0.165</u> <u>(0.154-0.176)</u>	0.957 (0.954-0.961)	0.821 (0.814-0.828)	0.037 (0.034-0.040)	0.071 (0.067-0.076)
LSTM	0.939 (0.918-0.961)	0.0001	0.118 (0.096-0.140)	0.957 (0.954-0.961)	<u>0.741</u> <u>(0.733-0.748)</u>	<u>0.026</u> <u>(0.023-0.029)</u>	<u>0.050</u> <u>(0.047-0.054)</u>
GRU	<u>0.952</u> <u>(0.932-0.973)</u>	<0.0001	0.250 (0.229-0.270)	0.957 (0.954-0.961)	0.733 (0.725-0.741)	0.025 (0.023-0.028)	0.049 (0.046-0.053)
Attention-based model							
Transformer	0.871 (0.837-0.904)	0.1053	0.074 (0.040-0.108)	0.957 (0.954-0.961)	0.420 (0.411-0.428)	0.012 (0.010-0.014)	0.023 (0.021-0.026)
RETAIN	0.746 (0.699-0.793)	0.0271	0.025 (-0.023-0.072)	0.957 (0.954-0.961)	0.281 (0.273-0.289)	0.010 (0.008-0.011)	0.019 (0.017-0.021)
External validation							
Tree-based model							
Random forest	0.833 (0.818-0.847)	<0.0001	0.086 (0.071-0.100)	0.950 (0.948-0.952)	0.407 (0.401-0.412)	0.032 (0.030-0.033)	0.061 (0.058-0.064)
GBM	0.860 (0.847-0.873)		0.118 (0.105-0.131)	0.950 (0.948-0.952)	0.517 (0.511-0.522)	0.038 (0.036-0.041)	0.074 (0.071-0.077)
RNN-based model							
Simple RNN	<u>0.958</u> <u>(0.953-0.963)</u>	<0.0001	0.241 (0.237-0.246)	0.950 (0.948-0.952)	<u>0.854</u> <u>(0.850-0.857)</u>	<u>0.117</u> <u>(0.113-0.120)</u>	<u>0.208</u> <u>(0.203-0.212)</u>
LSTM	0.940 (0.934-0.947)	<0.0001	<u>0.271</u> <u>(0.264-0.277)</u>	0.950 (0.948-0.952)	0.777 (0.773-0.782)	0.080 (0.077-0.083)	0.147 (0.143-0.151)
GRU	0.972 (0.968-0.975)	<0.0001	0.535 (0.531-0.539)	0.950 (0.948-0.952)	0.866 (0.862-0.870)	0.126 (0.122-0.130)	0.222 (0.218-0.227)
Attention-based model							
Transformer	0.871 (0.858-0.883)	<0.0001	0.179 (0.166-0.191)	0.950 (0.948-0.952)	0.527 (0.522-0.532)	0.039 (0.037-0.041)	0.075 (0.072-0.078)
RETAIN	0.755 (0.735-0.774)	<0.0001	0.091 (0.071-0.110)	0.950 (0.948-0.952)	0.248 (0.243-0.253)	0.025 (0.023-0.027)	0.049 (0.046-0.051)

*Bold indicates the best and underline indicates the second best.

*P-values were calculated using the DeLong method.

*Abbreviations: AUROC=area under the receiver operating characteristic curve, AUPRC=area under the precision-recall curve, GBM=gradient boosting machine, RNN=recurrent neural network, LSTM=long short-term memory, GRU=gated recurrent unit

Supplementary Table 3. Performance for detecting CDI with fewer features. The features, including vital signs and laboratory tests, were categorized into four groups: vital signs (SBP, DBP, heart rate, respiratory rate, and body temperature), complete blood count (CBC) test (WBC, hemoglobin, platelet, neutrophil, and ANC), liver function (LF) test (albumin, total protein, total bilirubin, AST, ALP, and ALT), and renal function (RF) test (BUN, creatinine, sodium, potassium, chloride, and total CO₂). Data with all possible combinations of feature groups were used for validation. Additional validation used data that 20% of used features were randomly masked.

	AUROC	P-value	AUPRC	Sensitivity	Specificity	Precision	F1-score
Internal validation							
Reference (GRU)	0.952 (0.932-0.973)	<0.0001	0.250 (0.229-0.270)	0.936 (0.932-0.940)	0.862 (0.856-0.867)	0.046 (0.043-0.050)	0.088 (0.084-0.093)
Without random masking							
Vital	0.858 (0.821-0.896)	0.0005	0.057 (0.020-0.095)	0.862 (0.856-0.867)	0.740 (0.733-0.747)	0.023 (0.021-0.026)	0.045 (0.042-0.049)
CBC	0.890 (0.858-0.923)	0.0014	0.102 (0.070-0.135)	0.904 (0.899-0.909)	0.740 (0.732-0.747)	0.024 (0.022-0.027)	0.048 (0.044-0.051)
LF	0.839 (0.798-0.879)	<0.0001	0.056 (0.016-0.097)	0.734 (0.726-0.742)	0.816 (0.809-0.822)	0.028 (0.025-0.031)	0.054 (0.050-0.058)
RF	0.854 (0.820-0.888)	<0.0001	0.062 (0.028-0.097)	0.787 (0.780-0.794)	0.763 (0.755-0.770)	0.023 (0.021-0.026)	0.045 (0.042-0.049)
Vital + CBC	0.933 (0.909-0.957)	0.0728	0.191 (0.167-0.215)	0.936 (0.932-0.940)	0.798 (0.791-0.804)	0.032 (0.029-0.035)	0.062 (0.058-0.067)
Vital + LF	0.910 (0.879-0.941)	0.0087	0.131 (0.099-0.162)	0.840 (0.834-0.847)	0.883 (0.877-0.888)	0.049 (0.045-0.053)	0.093 (0.088-0.098)
Vital + _RF	0.921 (0.896-0.946)	0.0291	0.144 (0.119-0.169)	0.904 (0.899-0.909)	0.791 (0.784-0.798)	0.030 (0.027-0.033)	0.058 (0.055-0.063)
CBC + LF	0.919 (0.889-0.948)	0.0060	0.150 (0.120-0.179)	0.894 (0.888-0.899)	0.833 (0.827-0.840)	0.037 (0.034-0.041)	0.071 (0.067-0.076)
CBC + RF	0.921 (0.896-0.945)	0.0129	0.177 (0.153-0.201)	0.872 (0.867-0.878)	0.833 (0.826-0.839)	0.036 (0.033-0.040)	0.070 (0.065-0.074)
LF + RF	0.907 (0.878-0.936)	0.0014	0.120 (0.091-0.149)	0.926 (0.921-0.930)	0.751 (0.744-0.759)	0.026 (0.024-0.029)	0.051 (0.047-0.055)
Vital + CBC + LF	0.943 (0.918-0.968)	0.1087	0.228 (0.203-0.252)	0.872 (0.867-0.878)	0.894 (0.889-0.899)	0.056 (0.052-0.060)	0.105 (0.100-0.111)
Vital + CBC + RF	0.948 (0.929-0.967)	0.4585	0.263 (0.244-0.283)	0.872 (0.867-0.878)	0.893 (0.887-0.898)	0.055 (0.052-0.059)	0.104 (0.099-0.110)
Vital + LF + RF	0.938 (0.913-0.963)	0.1273	0.208 (0.183-0.233)	0.936 (0.932-0.940)	0.832 (0.826-0.838)	0.039 (0.035-0.042)	0.074 (0.070-0.079)
CBC + LF + RF	0.937 (0.913-0.960)	0.0148	0.222 (0.199-0.245)	0.904 (0.899-0.909)	0.877 (0.871-0.882)	0.050 (0.047-0.054)	0.095 (0.090-0.100)
Vital + _CBC + LF + RF	0.952 (0.931-0.974)	0.4822	0.303 (0.282-0.324)	0.915 (0.910-0.920)	0.887 (0.882-0.893)	0.055 (0.052-0.059)	0.104 (0.099-0.110)
With random masking							
Vital	0.851 (0.812-0.891)	0.0003	0.055 (0.016-0.094)	0.851 (0.845-0.857)	0.735 (0.727-0.742)	0.023 (0.020-0.025)	0.044 (0.041-0.048)
CBC	0.857 (0.816-0.898)	0.0008	0.076 (0.036-0.117)	0.766 (0.759-0.773)	0.843 (0.837-0.849)	0.034 (0.031-0.037)	0.065 (0.061-0.069)
LF	0.845 (0.806-0.885)	<0.0001	0.059 (0.019-0.098)	0.787 (0.780-0.794)	0.775 (0.768-0.782)	0.025 (0.022-0.027)	0.048 (0.044-0.051)
RF	0.827 (0.788-0.866)	<0.0001	0.050 (0.011-0.089)	0.830 (0.823-0.836)	0.678 (0.670-0.686)	0.018 (0.016-0.021)	0.036 (0.033-0.039)
Vital + CBC	0.929 (0.904-0.955)	0.0456	0.189 (0.164-0.215)	0.883 (0.877-0.888)	0.847 (0.841-0.853)	0.040 (0.037-0.043)	0.076 (0.072-0.081)
Vital + LF	0.906 (0.880-0.933)	0.0162	0.101 (0.074-0.127)	0.787 (0.780-0.794)	0.885 (0.879-0.890)	0.047 (0.043-0.051)	0.088 (0.084-0.093)
Vital + _RF	0.926 (0.905-0.947)	0.1486	0.112 (0.091-0.133)	0.926 (0.921-0.930)	0.798 (0.791-0.805)	0.032 (0.029-0.035)	0.062 (0.058-0.066)
CBC + LF	0.914 (0.885-0.943)	0.0004	0.134 (0.104-0.163)	0.872 (0.867-0.878)	0.835 (0.829-0.841)	0.037 (0.034-0.040)	0.070 (0.066-0.075)
CBC + RF	0.913 (0.885-0.941)	0.0238	0.157 (0.129-0.185)	0.862 (0.856-0.867)	0.832 (0.826-0.839)	0.036 (0.033-0.039)	0.069 (0.064-0.073)
LF + RF	0.868 (0.829-0.906)	0.0001	0.084 (0.045-0.123)	0.851 (0.845-0.857)	0.759 (0.752-0.767)	0.025 (0.022-0.028)	0.048 (0.045-0.052)
Vital + CBC + LF	0.952 (0.931-0.973)	0.7594	0.259 (0.238-0.280)	0.862 (0.856-0.867)	0.921 (0.916-0.925)	0.073 (0.068-0.077)	0.134 (0.128-0.140)
Vital + CBC + RF	0.954 (0.937-0.971)	0.9780	0.297 (0.280-0.314)	0.862 (0.856-0.867)	0.917 (0.912-0.921)	0.069 (0.065-0.074)	0.129 (0.123-0.134)
Vital + LF + RF	0.925 (0.900-0.951)	0.0213	0.160 (0.135-0.185)	0.904 (0.899-0.909)	0.801 (0.794-0.808)	0.032 (0.029-0.035)	0.061 (0.057-0.066)
CBC + LF + RF	0.899 (0.867-0.931)	0.0006	0.114 (0.082-0.147)	0.755 (0.748-0.763)	0.907 (0.902-0.912)	0.055 (0.052-0.059)	0.103 (0.098-0.109)
Vital + _CBC + LF + RF	0.955 (0.937-0.974)	0.8688	0.293 (0.275-0.312)	0.904 (0.899-0.909)	0.905 (0.899-0.909)	0.064 (0.060-0.068)	0.119 (0.114-0.125)

	AUROC	P-value	AUPRC	Sensitivity	Specificity	Precision	F1-score
External validation							
Reference (GRU)	0.972 (0.968-0.975)		0.535 (0.531-0.539)	0.900 (0.897-0.904)	0.910 (0.907-0.913)	0.169 (0.165-0.173)	0.284 (0.279-0.289)
Without random masking							
Vital	0.851 (0.837-0.865)	<0.0001	0.142 (0.128-0.156)	0.741 (0.737-0.746)	0.810 (0.806-0.815)	0.074 (0.071-0.076)	0.134 (0.130-0.138)
CBC	0.896 (0.886-0.907)	<0.0001	0.195 (0.184-0.206)	0.835 (0.831-0.839)	0.798 (0.794-0.803)	0.078 (0.075-0.081)	0.142 (0.138-0.146)
LF	0.867 (0.854-0.881)	<0.0001	0.189 (0.176-0.202)	0.802 (0.798-0.806)	0.773 (0.768-0.777)	0.067 (0.064-0.070)	0.123 (0.120-0.127)
RF	0.854 (0.840-0.867)	<0.0001	0.168 (0.155-0.182)	0.810 (0.806-0.814)	0.734 (0.730-0.739)	0.058 (0.056-0.061)	0.109 (0.106-0.112)
Vital + CBC	0.947 (0.941-0.954)	<0.0001	0.370 (0.363-0.376)	0.874 (0.870-0.877)	0.880 (0.876-0.884)	0.129 (0.125-0.133)	0.225 (0.220-0.229)
Vital + LF	0.938 (0.931-0.946)	<0.0001	0.388 (0.380-0.396)	0.868 (0.864-0.871)	0.858 (0.854-0.862)	0.110 (0.107-0.114)	0.196 (0.191-0.200)
Vital + _RF	0.926 (0.918-0.935)	<0.0001	0.355 (0.346-0.363)	0.869 (0.865-0.873)	0.810 (0.806-0.815)	0.085 (0.082-0.088)	0.155 (0.151-0.159)
CBC + LF	0.935 (0.928-0.943)	<0.0001	0.309 (0.302-0.317)	0.879 (0.875-0.882)	0.851 (0.847-0.854)	0.107 (0.103-0.110)	0.190 (0.186-0.195)
CBC + RF	0.932 (0.925-0.940)	<0.0001	0.303 (0.296-0.311)	0.879 (0.875-0.882)	0.840 (0.836-0.844)	0.100 (0.097-0.103)	0.180 (0.176-0.184)
LF + RF	0.927 (0.919-0.936)	<0.0001	0.352 (0.344-0.361)	0.888 (0.884-0.891)	0.811 (0.807-0.816)	0.087 (0.084-0.090)	0.159 (0.155-0.163)
Vital + CBC + LF	0.964 (0.960-0.969)	<0.0001	0.469 (0.464-0.474)	0.910 (0.906-0.913)	0.893 (0.890-0.897)	0.148 (0.144-0.152)	0.254 (0.249-0.259)
Vital + CBC + RF	0.961 (0.956-0.966)	<0.0001	0.462 (0.457-0.467)	0.886 (0.883-0.890)	0.898 (0.894-0.901)	0.150 (0.146-0.153)	0.256 (0.251-0.261)
Vital + LF + RF	0.961 (0.956-0.966)	<0.0001	0.504 (0.499-0.510)	0.938 (0.935-0.940)	0.856 (0.853-0.860)	0.117 (0.114-0.121)	0.208 (0.204-0.213)
CBC + LF + RF	0.951 (0.945-0.957)	<0.0001	0.393 (0.387-0.399)	0.913 (0.910-0.916)	0.853 (0.849-0.857)	0.112 (0.109-0.116)	0.200 (0.196-0.204)
Vital + _CBC + LF + RF	0.970 (0.967-0.974)	0.0439	0.522 (0.518-0.526)	0.939 (0.937-0.942)	0.885 (0.881-0.888)	0.142 (0.138-0.146)	0.247 (0.242-0.252)
With random masking							
Vital	0.826 (0.811-0.841)	<0.0001	0.113 (0.097-0.128)	0.777 (0.773-0.782)	0.729 (0.724-0.734)	0.055 (0.053-0.058)	0.103 (0.100-0.106)
CBC	0.843 (0.828-0.858)	<0.0001	0.139 (0.124-0.153)	0.734 (0.729-0.738)	0.793 (0.788-0.797)	0.067 (0.064-0.070)	0.123 (0.119-0.127)
LF	0.868 (0.854-0.881)	<0.0001	0.189 (0.175-0.202)	0.812 (0.807-0.816)	0.764 (0.759-0.768)	0.065 (0.063-0.068)	0.121 (0.117-0.124)
RF	0.850 (0.836-0.863)	<0.0001	0.163 (0.149-0.177)	0.760 (0.755-0.765)	0.781 (0.776-0.785)	0.066 (0.063-0.069)	0.121 (0.118-0.125)
Vital + CBC	0.904 (0.894-0.914)	<0.0001	0.234 (0.223-0.244)	0.858 (0.854-0.862)	0.789 (0.784-0.793)	0.076 (0.073-0.079)	0.140 (0.136-0.144)
Vital + LF	0.917 (0.908-0.927)	<0.0001	0.298 (0.288-0.307)	0.874 (0.870-0.877)	0.795 (0.790-0.799)	0.080 (0.077-0.083)	0.146 (0.142-0.150)
Vital + _RF	0.878 (0.866-0.889)	<0.0001	0.200 (0.189-0.212)	0.788 (0.784-0.793)	0.795 (0.791-0.800)	0.073 (0.070-0.075)	0.133 (0.129-0.137)
CBC + LF	0.930 (0.922-0.938)	<0.0001	0.288 (0.280-0.296)	0.874 (0.870-0.877)	0.845 (0.841-0.849)	0.103 (0.099-0.106)	0.184 (0.179-0.188)
CBC + RF	0.926 (0.917-0.934)	<0.0001	0.275 (0.267-0.284)	0.885 (0.881-0.888)	0.823 (0.818-0.827)	0.092 (0.089-0.095)	0.167 (0.163-0.171)
LF + RF	0.931 (0.923-0.940)	<0.0001	0.382 (0.373-0.390)	0.871 (0.867-0.874)	0.832 (0.828-0.836)	0.095 (0.092-0.099)	0.172 (0.168-0.176)
Vital + CBC + LF	0.961 (0.955-0.966)	0.0002	0.462 (0.457-0.468)	0.933 (0.930-0.936)	0.869 (0.865-0.872)	0.126 (0.123-0.130)	0.222 (0.218-0.227)
Vital + CBC + RF	0.936 (0.929-0.944)	<0.0001	0.345 (0.338-0.353)	0.880 (0.876-0.884)	0.858 (0.854-0.862)	0.112 (0.108-0.115)	0.198 (0.194-0.203)
Vital + LF + RF	0.964 (0.959-0.969)	0.0062	0.535 (0.530-0.540)	0.893 (0.889-0.896)	0.908 (0.905-0.911)	0.164 (0.160-0.168)	0.278 (0.273-0.283)
CBC + LF + RF	0.954 (0.948-0.960)	<0.0001	0.437 (0.431-0.443)	0.919 (0.916-0.922)	0.861 (0.857-0.865)	0.118 (0.115-0.122)	0.210 (0.205-0.214)
Vital + _CBC + LF + RF	0.954 (0.948-0.960)	<0.0001	0.427 (0.421-0.433)	0.891 (0.888-0.894)	0.881 (0.878-0.885)	0.132 (0.129-0.136)	0.231 (0.226-0.235)

Supplementary Table 4. Antibiotics concept IDs (RxNorm) used in the study

Antibiotics	Drug name	Concept ID	Antibiotics	Drug name	Concept ID
Penicillin	Amoxicillin	1713671, 1713694, 1713697, 2051753, 19073183, 19073187, 19115197, 19128705	Carbapenem	Meropenem	35606001, 35606006, 42956761
	Clavulanate	1713671, 1713694, 1713697, 2051753, 19115197		Ertapenem	35606488
	Piperacillin	44084071, 46275427, 46275444		Cilastatin	35604068
	tazobactam	46275427, 46275444		Imipenem	35604068
	Nafcillin	35605336		Doripenem	40230701
	Ampicillin	19073219, 19079893, 35605341, 40838329	Glycopeptide	Teicoplanin	21025554, 21172842
	Sulbactam	40838329	Macrolide	Clarithromycin	1750501, 1750562, 19058072, 21123288
	Penicillin	21024671		Azithromycin	19073777, 35603389
Cephalosporin-1	Cefazolin	19130200, 44097647, 46287338, 46287345	Clindamycin	Clindamycin	997892, 21058842, 36809661, 41342636, 41350631, 43521561
	Cephradine	1786843, 1786844, 19128750			
	Cefadroxil	44131388	Tetracycline	Tetracycline	36282880
Cephalosporin-2	Cefuroxime	19075001, 21091450, 46287419		Doxycycline	46233710
	Cefditoren	35139023, 42972205		Minocycline	1708904
	Cefotetan	35605996		Tigecycline	1742434
Cephalosporin-3	Cefixime	35142360, 42943315	Oxazolidinone	Linezolid	1736892, 46276326
	Ceftriaxone	46287328, 46287335			
	Cefpodoxime	19074932, 19115230			
	Cefotaxime	19074905, 46275706, 46275711			
	Ceftazidime	46275516			
Cephalosporin-4	Cefepime	46287354, 46287358	Fluoroquinolone	Levofloxacin	1742254, 1742255, 1742284, 19107185, 21126995, 36896008, 42921483, 46287443, 46287449
Monobactam	Aztreonam	46287307		Ciprofloxacin	1797515, 1797516, 36896011, 36896594, 42920759, 46287382
				Moxifloxacin	1716905, 21176261, 41437171
			Trimethoprim-Sulfamethoxazole	Sulfamethoxazole	1836433, 40220483
				trimethoprim	1836433, 40220483

Supplementary Table 5. Antacid concept IDs (RxNorm) used in the study

Antacid	Drug name	Concept ID
Proton pump inhibitors	Pantoprazole	41271459, 41302588, 948080
	Lansoprazole	19095273, 19095231, 19133802, 19039961
	Omeprazole	21161812, 19101746, 19101745, 19081766, 19081767, 904455, 40992339, 904454, 19112920
	Rabeprazole	40834416, 41021231, 35152933
	Elaprazole	42961063
	Dexlansoprazole	19039961, 19133802
H2 blocker	Famotidine	19077241
	Cimetidine	997341, 42944094, 2073468, 2033070, 42922401, 19081086, 42922400, 2073465, 42944157
	Lafutidine	42961124
Potassium-competitive acid blocker	Tegoprazan	2012376

Supplementary Table 6. Measurement concept IDs (LOINC) used in the study

Measurement	Concept ID	Measurement	Concept ID
C. Difficile	3044936	Total protein	3020630
SBP	3004249, 21490853	Total bilirubin	3024128
DBP	3012888, 21490851	AST	3013721
Heart rate	3027018	ALP	3035995
Respiratory rate	3024171	ALT	3006923
Body temperature	3020891	BUN	3013682
WBC	3000905	Creatinine	3016723
Hemoglobin	3000963	Sodium	3019550
Platelet	3024929	Potassium	3023103
Neutrophil	3012608	Chloride	3014576
ANC	3017354	Total CO ₂	3015632
Albumin	3024561	CRP	3010156, 3020460

Supplementary Table 7. Procedure concept IDs (SNOMED) used in the study

Operation	Concept ID
Colectomy	4017464, 4096461, 4097958, 4123402, 4163975, 4195151, 4197412, 4199951, 4199952, 4219780, 4225427, 4233412, 4262950