

Table S1 The top-10 most common and most fatal types of cancer in MIMIC database

Cancer type	Count	Death
Top-10 most common cancer type		
Secondary malignant neoplasm of bone and bone marrow	799	201
Malignant neoplasm of liver, secondary	758	237
Secondary malignant neoplasm of lung	723	184
Secondary malignant neoplasm of brain and spinal cord	703	140
Secondary malignant neoplasm of other specified sites	423	80
Malignant neoplasm of other parts of bronchus or lung	370	99
Malignant neoplasm of liver, primary	329	68
Other malignant lymphomas, unspecified site, extranodal and solid organ sites	315	66
Malignant neoplasm of upper lobe, bronchus or lung	309	51
Secondary malignant neoplasm of retroperitoneum and peritoneum	299	79
Top-10 most fatal cancer type		
Mycosis fungoides, unspecified site, extranodal and solid organ sites	22	11
Acute myeloid leukemia, in relapse	13	6
Secondary and unspecified malignant neoplasm of lymph nodes of multiple sites	34	15
Acute myeloid leukemia, without mention of having achieved remission	189	78
Secondary malignant neoplasm of pleura	207	78
Malignant neoplasm of pancreas, part unspecified	32	12
Reticulosarcoma, unspecified site, extranodal and solid organ sites	17	6
Acute lymphoid leukemia, without mention of having achieved remission	38	13
Malignant neoplasm of middle lobe, bronchus or lung	30	10
Other malignant neoplasm without specification of site	151	50

Table S2 The top-10 most common and most fatal types of cancer in eICU database

Top-10 most common cancer type	Count	Death
oncology chest tumors primary lung cancer	1377	294
neurologic CNS mass lesions brain tumor	1065	79
oncology chest tumors metastatic lung CA	477	132
oncology GI tumors colon CA	411	61
oncology GU tumors prostate CA	326	43
oncology GI tumors liver CA CA metastatic to liver	250	68
oncology chest tumors breast CA female	234	40
oncology GI tumors esophageal CA	226	33
oncology hematologic malignancy lymphoproliferative disease non-Hodgkin's lymphoma	219	50
oncology GU tumors renal cell CA right kidney	202	33
Top-10 most fatal cancer type	Count	Death
oncology unknown primary metastatic adenocarcinoma unknown primary	10	5
hematology oncology and leukemia leukemia acute myelogenous	137	52
oncology GI tumors colon CA cecum	20	7
oncology hematologic malignancy leukemia acute lymphocytic	36	12
pulmonary pleural disorders pleural effusion malignant	113	36
oncology chest tumors mediastinal tumor lymphoma	45	13
oncology skin, muscle and skeletal tumors bone tumors bony metastasis	142	41
oncology chest tumors metastatic lung CA	477	132
oncology GI tumors liver CA CA metastatic to liver	250	68
hematology oncology and leukemia lymphoproliferative disease Hodgkin's disease	43	11

CNS central nervous system, GI gastrointestinal, GU Genitourinary, CA cancer

Table S3 Manually classified cancer list of MIMIC database according to the belonging system or location

ICD9 code	Long title	Manually classification
1504	Malignant neoplasm of middle third of esophagus	Digestive
1505	Malignant neoplasm of lower third of esophagus	Digestive
1508	Malignant neoplasm of other specified part of esophagus	Digestive
1509	Malignant neoplasm of esophagus, unspecified site	Digestive
1510	Malignant neoplasm of cardia	Digestive
1512	Malignant neoplasm of pyloric antrum	Digestive
1514	Malignant neoplasm of body of stomach	Digestive
1518	Malignant neoplasm of other specified sites of stomach	Digestive
1519	Malignant neoplasm of stomach, unspecified site	Digestive
1520	Malignant neoplasm of duodenum	Digestive
1531	Malignant neoplasm of transverse colon	Digestive
1532	Malignant neoplasm of descending colon	Digestive
1533	Malignant neoplasm of sigmoid colon	Digestive
1534	Malignant neoplasm of cecum	Digestive
1536	Malignant neoplasm of ascending colon	Digestive
1538	Malignant neoplasm of other specified sites of large intestine	Digestive
1539	Malignant neoplasm of colon, unspecified site	Digestive
1540	Malignant neoplasm of rectosigmoid junction	Digestive
1541	Malignant neoplasm of rectum	Digestive
1548	Malignant neoplasm of other sites of rectum, rectosigmoid junction, and anus	Digestive
1550	Malignant neoplasm of liver, primary	Digestive
1551	Malignant neoplasm of intrahepatic bile ducts	Digestive
1552	Malignant neoplasm of liver, not specified as primary or secondary	Digestive
1560	Malignant neoplasm of gallbladder	Digestive
1561	Malignant neoplasm of extrahepatic bile ducts	Digestive
1562	Malignant neoplasm of ampulla of vater	Digestive
1570	Malignant neoplasm of head of pancreas	Digestive
1572	Malignant neoplasm of tail of pancreas	Digestive
1578	Malignant neoplasm of other specified sites of pancreas	Digestive
1579	Malignant neoplasm of pancreas, part unspecified	Digestive
1580	Malignant neoplasm of retroperitoneum	Digestive
1588	Malignant neoplasm of specified parts of peritoneum	Digestive
1619	Malignant neoplasm of larynx, unspecified	Respiratory
1622	Malignant neoplasm of main bronchus	Respiratory
1623	Malignant neoplasm of upper lobe, bronchus or lung	Respiratory
1624	Malignant neoplasm of middle lobe, bronchus or lung	Respiratory
1625	Malignant neoplasm of lower lobe, bronchus or lung	Respiratory
1628	Malignant neoplasm of other parts of bronchus or lung	Respiratory
1629	Malignant neoplasm of bronchus and lung, unspecified	Respiratory
1725	Malignant melanoma of skin of trunk, except scrotum	Skin
1729	Melanoma of skin, site unspecified	Skin
1733	Oth and unspec malignant neoplasm of skin	Skin
1748	Malignant neoplasm of other specified sites of female breast	Breast and thyroid
1749	Malignant neoplasm of breast (female), unspecified	Breast and thyroid
1820	Malignant neoplasm of corpus uteri, except isthmus	Genitourinary
1830	Malignant neoplasm of ovary	Genitourinary
185	Malignant neoplasm of prostate	Genitourinary
1888	Malignant neoplasm of other specified sites of bladder	Genitourinary
1889	Malignant neoplasm of bladder, part unspecified	Genitourinary
1890	Malignant neoplasm of kidney, except pelvis	Genitourinary
1911	Malignant neoplasm of frontal lobe	Brain
1912	Malignant neoplasm of temporal lobe	Brain
1913	Malignant neoplasm of parietal lobe	Brain
1918	Malignant neoplasm of other parts of brain	Brain
1919	Malignant neoplasm of brain, unspecified	Brain
193	Malignant neoplasm of thyroid gland	Breast and thyroid
1960	Secondary and unspecified malignant neoplasm of lymph nodes of head, face, and neck	Secondary
1961	Secondary and unspecified malignant neoplasm of intrathoracic lymph nodes	Secondary
1962	Secondary and unspecified malignant neoplasm of intra-abdominal lymph nodes	Secondary
1963	Secondary and unspecified malignant neoplasm of lymph nodes of axilla and upper limb	Secondary
1965	Secondary and unspecified malignant neoplasm of lymph nodes of inguinal region and lower limb	Secondary
1966	Secondary and unspecified malignant neoplasm of intrapelvic lymph nodes	Secondary
1968	Secondary and unspecified malignant neoplasm of lymph nodes of multiple sites	Secondary
1969	Secondary and unspecified malignant neoplasm of lymph nodes, site unspecified	Secondary
1970	Secondary malignant neoplasm of lung	Secondary
1971	Secondary malignant neoplasm of mediastinum	Secondary
1972	Secondary malignant neoplasm of pleura	Secondary
1973	Secondary malignant neoplasm of other respiratory organs	Secondary
1974	Secondary malignant neoplasm of small intestine including duodenum	Secondary
1975	Secondary malignant neoplasm of large intestine and rectum	Secondary
1976	Secondary malignant neoplasm of retroperitoneum and peritoneum	Secondary
1977	Malignant neoplasm of liver, secondary	Secondary
1978	Secondary malignant neoplasm of other digestive organs and spleen	Secondary
1980	Secondary malignant neoplasm of kidney	Secondary
1981	Secondary malignant neoplasm of other urinary organs	Secondary
1982	Secondary malignant neoplasm of skin	Secondary
1983	Secondary malignant neoplasm of brain and spinal cord	Secondary
1984	Secondary malignant neoplasm of other parts of nervous system	Secondary
1985	Secondary malignant neoplasm of bone and bone marrow	Secondary
1986	Secondary malignant neoplasm of ovary	Secondary
1987	Secondary malignant neoplasm of adrenal gland	Secondary
19882	Secondary malignant neoplasm of genital organs	Secondary
19889	Secondary malignant neoplasm of other specified sites	Secondary
1991	Other malignant neoplasm without specification of site	Secondary
20000	Reticulosarcoma, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20020	Burkitt's tumor or lymphoma, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20080	Other named variants of lymphosarcoma and reticulosarcoma, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20190	Hodgkin's disease, unspecified type, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20200	Nodular lymphoma, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20210	Mycosis fungoides, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20240	Leukemic reticuloendotheliosis, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20280	Other malignant lymphomas, unspecified site, extranodal and solid organ sites	Hematologic malignancy
20281	Other malignant lymphomas, lymph nodes of head, face, and neck	Hematologic malignancy
20283	Other malignant lymphomas, intra-abdominal lymph nodes	Hematologic malignancy
20288	Other malignant lymphomas, lymph nodes of multiple sites	Hematologic malignancy
20300	Multiple myeloma, without mention of having achieved remission	Hematologic malignancy
20400	Acute lymphoid leukemia, without mention of having achieved remission	Hematologic malignancy
20410	Chronic lymphoid leukemia, without mention of having achieved remission	Hematologic malignancy
20500	Acute myeloid leukemia, without mention of having achieved remission	Hematologic malignancy
20501	Acute myeloid leukemia, in remission	Hematologic malignancy
20502	Acute myeloid leukemia, in relapse	Hematologic malignancy
20510	Chronic myeloid leukemia, without mention of having achieved remission	Hematologic malignancy

Table S4 Manually classified cancer list of eICU database according to the belonging system or location

ICD9 code	Diagnoses	Manually classification
145.9	oncology head and neck tumors mouth and jaw tumor oral cavity squamous cell CA	Head and neck
148.9	oncology head and neck tumors neck tumor oro/hypopharyngeal CA	Head and neck
151.9	oncology GI tumors gastric CA	Digestive
152.9	oncology GI tumors intestinal CA	Digestive
153	oncology GI tumors colon CA right hemicolon	Digestive
153.3	oncology GI tumors colon CA sigmoid	Digestive
153.4	oncology GI tumors colon CA cecum	Digestive
153.9	oncology GI tumors colon CA	Digestive
154.3	oncology GI tumors anal CA	Digestive
155	oncology GI tumors liver CA hepatocellular CA	Digestive
156.9	oncology GI tumors cholangiocarcinoma	Digestive
157.9	oncology GI tumors pancreatic tumor pancreatic CA	Digestive
161.9	oncology head and neck tumors neck tumor laryngeal CA	Head_neck
162.9	oncology chest tumors primary lung cancer	Lung
170.9	oncology skin, muscle and skeletal tumors bone tumors	Skin, muscle and skeletal
171.9	oncology skin, muscle and skeletal tumors soft tissue sarcoma	Skin, muscle and skeletal
172.9	oncology skin, muscle and skeletal tumors melanoma	Skin, muscle and skeletal
173.9	oncology skin, muscle and skeletal tumors basal cell CA	Skin, muscle and skeletal
174.9	oncology chest tumors breast CA female	Breast and thyroid
179	oncology GU tumors uterine CA	Genitourinary
180.9	oncology GU tumors cervical CA	Genitourinary
183	oncology GU tumors ovarian CA	Genitourinary
185	oncology GU tumors prostate CA	Genitourinary
186.9	oncology GU tumors testicular CA	Genitourinary
188.9	oncology GU tumors bladder CA	Genitourinary
189	oncology GU tumors renal cell CA right kidney	Genitourinary
191.9	neurologic CNS mass lesions brain tumor	Brain
192.2	neurologic CNS mass lesions spinal tumor	Brain
192.9	oncology GI tumors esophageal CA	Brain
192.9	oncology CNS tumors spinal cord tumors	Brain
193	oncology head and neck tumors neck tumor thyroid tumor papillary CA	Breast and thyroid
197	oncology chest tumors metastatic lung CA	Secondary
197.2	pulmonary pleural disorders pleural effusion malignant	Secondary
197.6	oncology GI tumors abdominal carcinomatosis	Secondary
197.7	oncology GI tumors liver CA CA metastatic to liver	Secondary
198.3	neurologic CNS mass lesions brain tumor metastatic brain tumor	Secondary
198.5	oncology skin, muscle and skeletal tumors bone tumors bony metastasis	Secondary
199	oncology unknown primary metastatic adenocarcinoma	Secondary
199.1	oncology unknown primary metastatic adenocarcinoma unknown primary	Secondary
201.9	hematology oncology and leukemia lymphoproliferative disease Hodgkin's disease	Hematologic malignancy
202.8	oncology hematologic malignancy lymphoproliferative disease non-Hodgkin's lymphoma	Hematologic malignancy
202.82	oncology chest tumors mediastinal tumor lymphoma	Hematologic malignancy
203	oncology hematologic malignancy multiple myeloma	Hematologic malignancy
204	oncology hematologic malignancy leukemia acute lymphocytic	Hematologic malignancy
204.1	oncology hematologic malignancy leukemia chronic lymphocytic	Hematologic malignancy
205	hematology oncology and leukemia leukemia acute myelogenous	Hematologic malignancy
205.1	oncology hematologic malignancy leukemia chronic myelogenous	Hematologic malignancy

CNS, central nervous system; GI, gastrointestinal; GU, Genitourinary, CA, cancer.

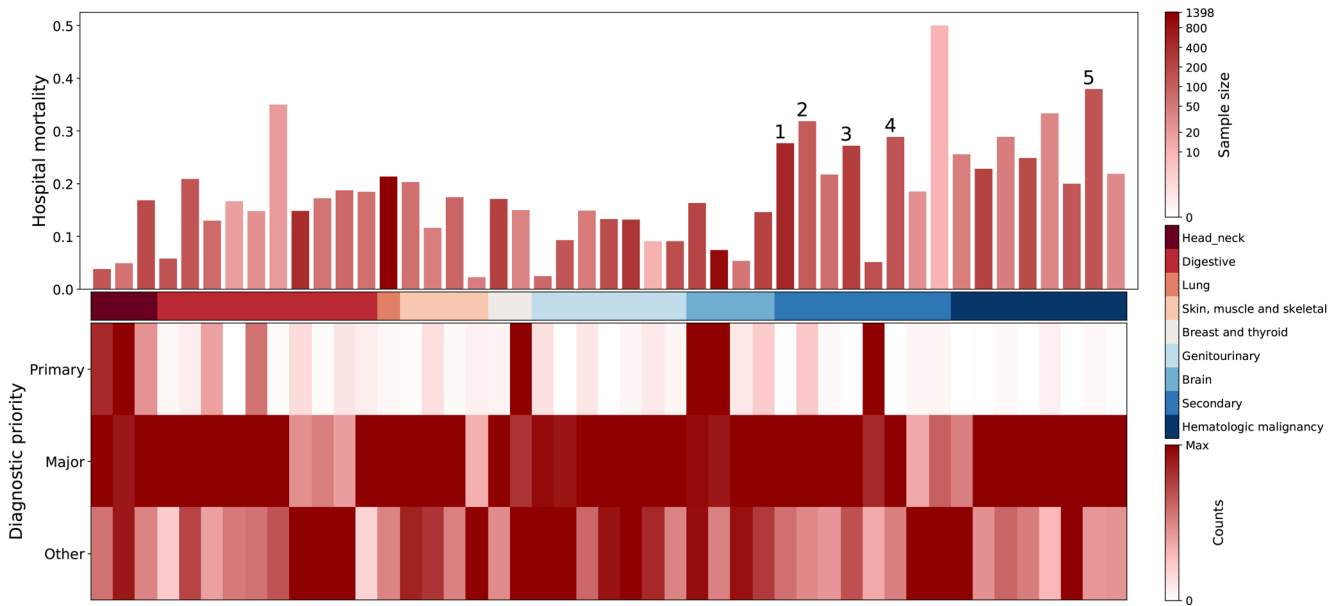


Figure S1 The mortality and distribution of positions of ICD-level diagnoses of EICU database. In the upper part, the color of bars referred to the number of patients with specific cancer. In the middle part, the color blocks referred to the manually classified according to the location or organ system. In the lower part was the heatmap. The color in the primary/major/other diagnosis referred to its frequency. The note label of figure above were: 1, metastatic lung cancer; 2, malignant pleural disorders; 3, cancer metastatic to liver; 4, bony metastasis; 5, acute myeloid leukemia.

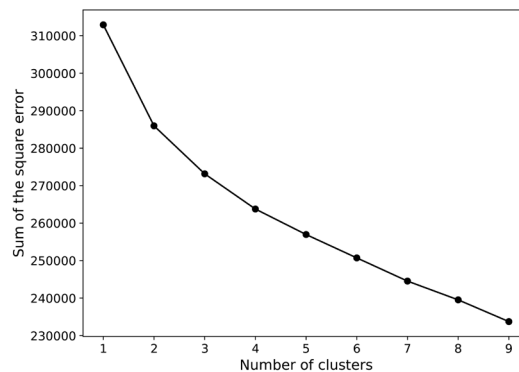


Figure S2 The elbow plot of K-means clustering of the ICU cancer patient in MIMIC database. The sum of the square error was calculated by summing within-cluster Euclidian distance of every observation to its nearest cluster center.

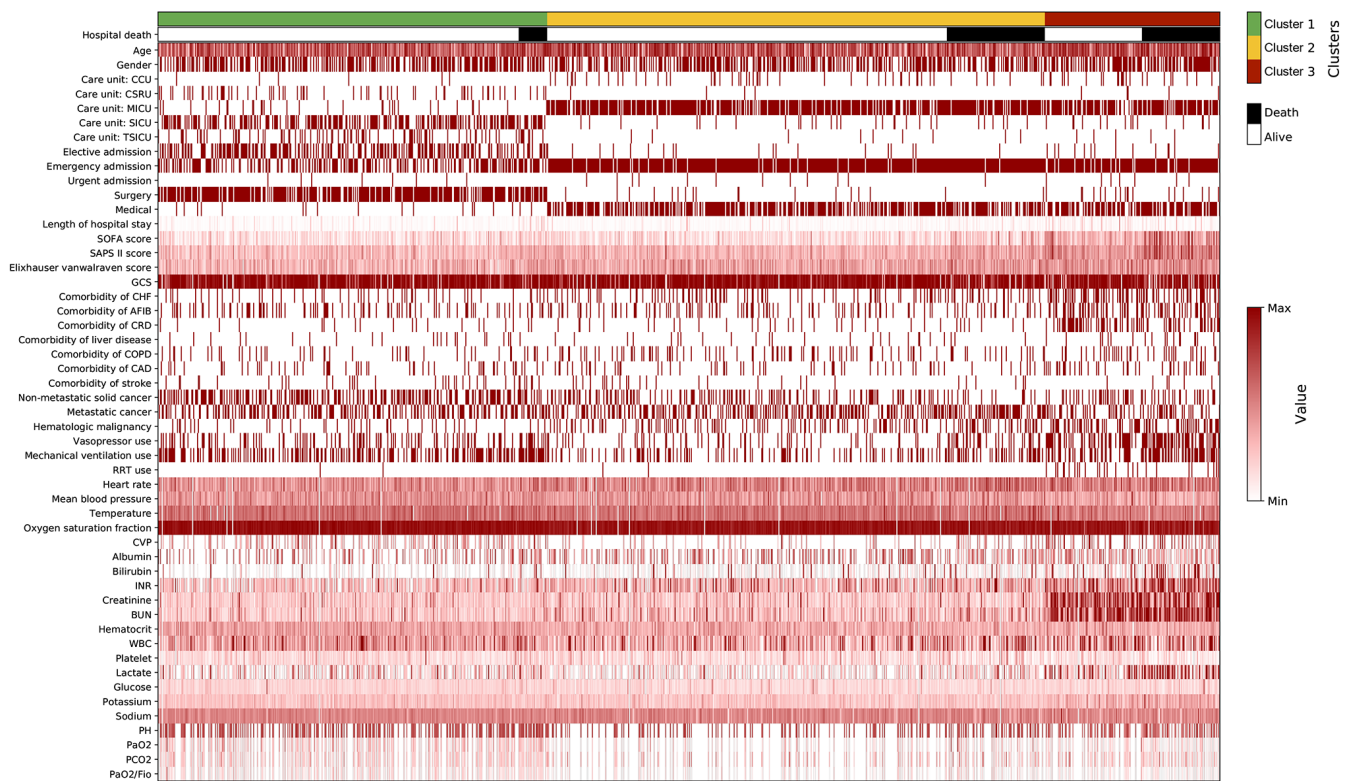


Figure S3 K-means clustering revealed three clinical subtypes. The depth of red color in the heatmap referred to the relative value of the variables. Names of the variables were annotated on the left. CCU, cardiac care unit; CSRU, Cardiac surgery recovery unit; MICU, medical intensive care unit; SICU surgery intensive care unit; TSICU, trauma/surgical intensive care unit; SOFA, sequential organ failure assessment; SAPSII, Simplified Acute Physiology Score II; GCS, Glasgow Coma Scale; CHF, chronic heart failure; AFIB, atrial fibrillation; CRD, chronic renal disease; COPD, chronic obstructive pulmonary disease; CAD, coronary artery disease; RRT, renal replacement treatment; CVP, central venal pressure; INR, international normalized ratio; BUN, blood urea nitrogen; WBC, white blood cells; PaO₂, artery partial pressure of oxygen; PCO₂, partial pressure of carbon dioxide; FiO₂, fraction of inspired oxygen.

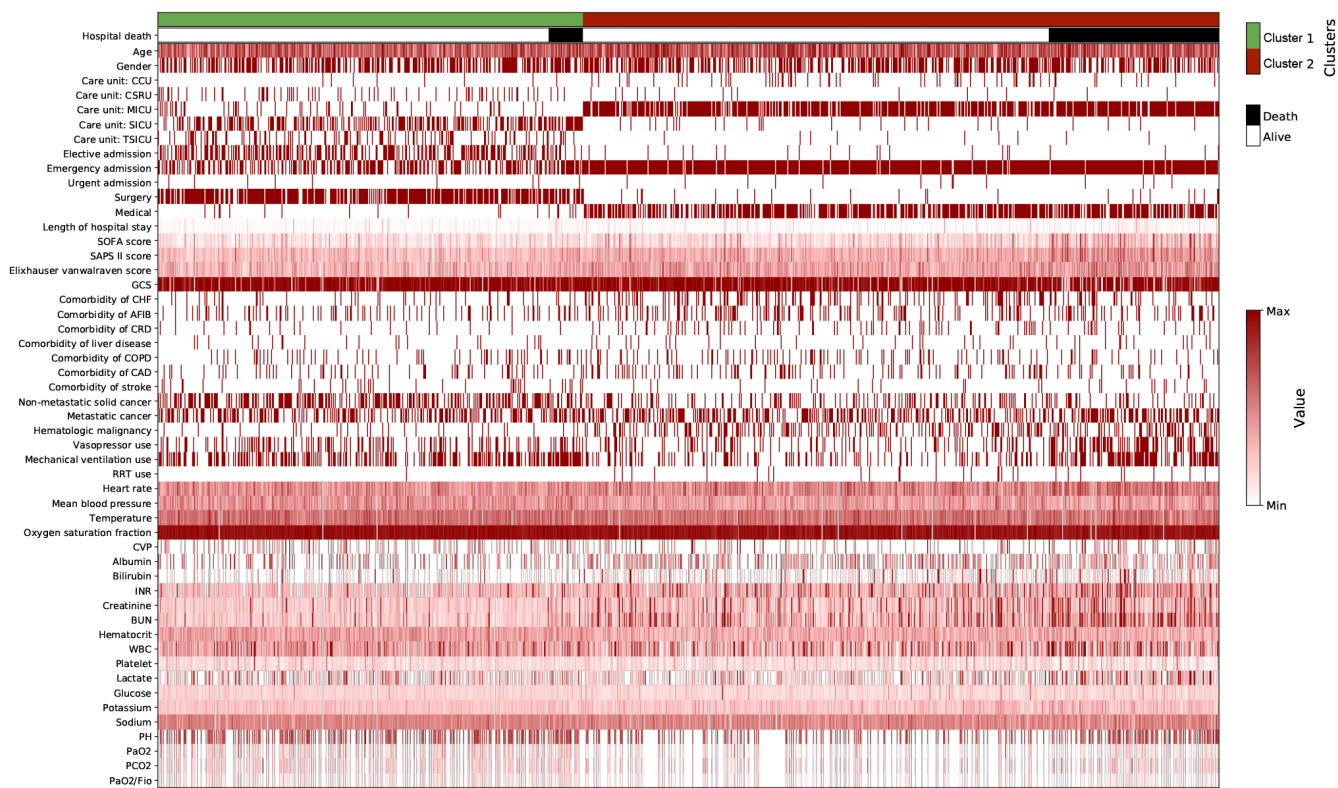


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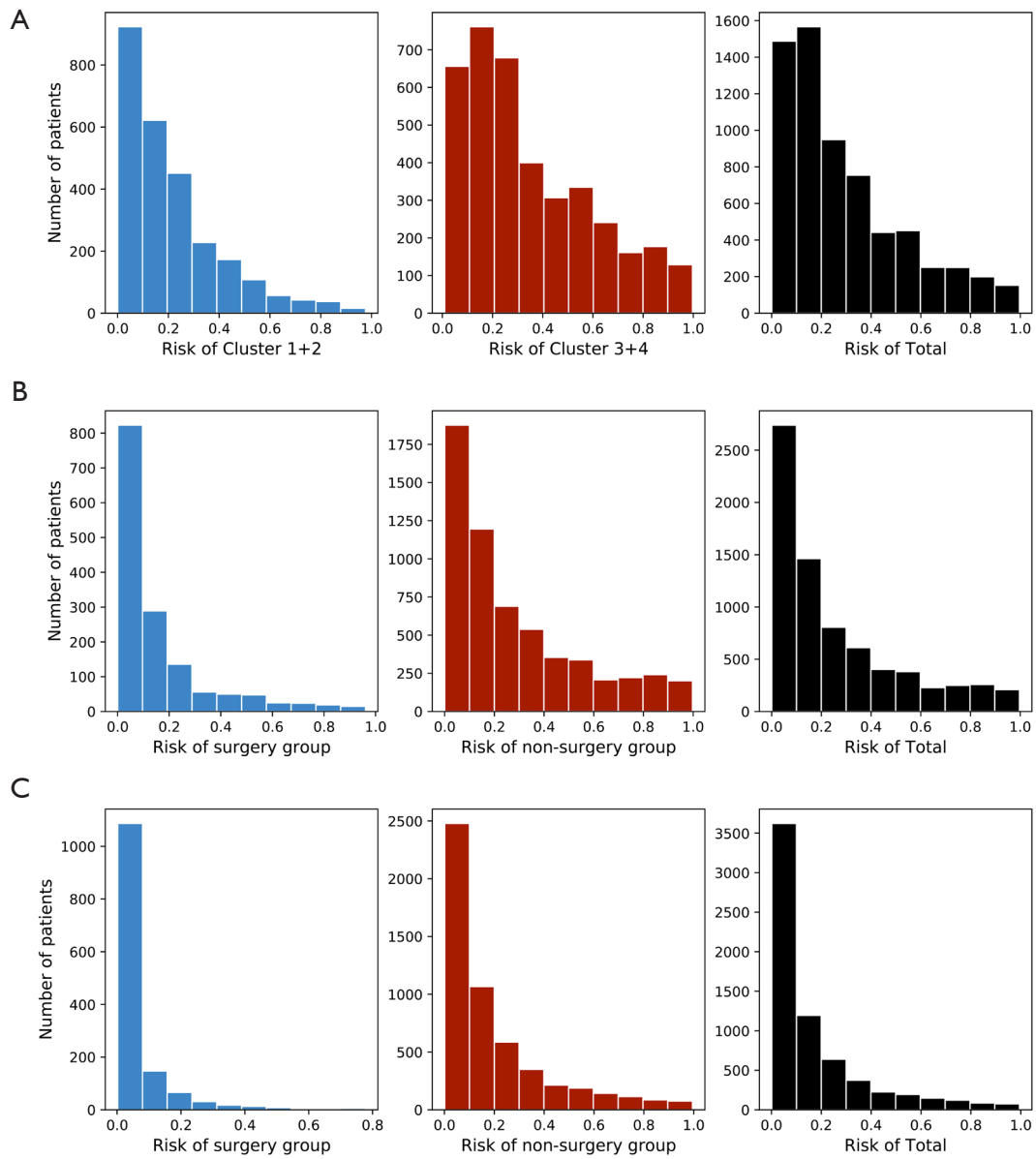


Figure S5 The number of patients in each risk decile of different clusters or groups for (A) SAPS II in MIMIC database; (B) SAPSII in eICU database; (C) APACHE IV in eICU database.