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Shock in China 2018 (SIC-study): a cross-sectional survey

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Background: Shock is a critical illness that seriously threatens the lives of patients. This study explains the epidemiology of shock, mortality of shock, and identify factors that related to hospital death.

Methods: This is a multi-centre cross-sectional survey, which included 1,064 tertiary hospitals in 31 provinces, municipalities, and autonomous regions across China mainland. Totally 289,428 patients who diagnosed with shock based on the ICD-10 abstracted from the Hospital Quality Monitoring System (HQMS) in 2018, a national database administrated by National Health Commission of the PRC.

Results: Patients diagnosed with shock were screened and classified according to the type of shock. Regression analysis was used to identify factors that related to death. A total of 79,668,156 medical records were included in HQMS in 2018, from which a total of 289,428 records with shock were identified. Hypovolemic shock occurred in 128,436 cases (44.38%), septic shock occurred in 121,543 cases (41.99%), cardiogenic shock occurred in 44,597 cases (15.41), and obstructive shock occurred in 3,168 cases (1.09%). Of these, 8,147 cases (2.81%) had mixed shock, which means had two or more types of shock. For all

the shock cases, the top three frequent concomitant diseases recorded were circulatory system diseases (55.22%), digestive system diseases (53.64%), and respiratory system diseases (53.31%). Of the four types of shock, cases with cardiogenic shock had the highest in-hospital mortality (31.6%), followed by those with obstructive shock (25.2%), septic shock (22.9%), and hypovolemic shock (15.5%). Interestingly, the combination of shock and malignant tumors is one of the major factors that related to hospital deaths.

Conclusions: Shock is a serious disease with a high fatality rate and huge clinical costs. According to this epidemiological survey of shock in China 2018, we should clarify the factors related to the hospital death in shock cases.

Keywords: Shock; Hospital Quality Monitoring System (HQMS); outcome; risk factor; epidemiology

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Introduction

Shock is defined as a life-threatening circulatory failure due to reduced oxygen delivery and/or increased oxygen consumption or insufficient oxygen utilization of cells and tissues, resulting in high morbidity and mortality (1,2). Shock is not only a disease but also a circulatory disorder syndrome whose pathophysiological process might be triggered by a variety of pathogenic factors leading to metabolic disorders. Knowing the epidemiological characteristics of shock patients can allow clinicians to deeply understand the disease process and prevent disease progression. A cohort study conducted in the emergency department of Danish University Hospital from 2010 to 2011 showed that hypovolemic shock (30.8%) and septic shock (27.2%) were the most common types of shock in 1,553 shock patients, followed by non-septic symptomatic shock (23.4%) and cardiogenic shock (14.0%), while obstructive shock (0.9%) was relatively rare (3). A clinical trial involving more than 1,600 patients with unexplained shock showed that the proportion of septic shock was approximately 62%; others included cardiogenic shock in 16% and hypovolemic shock in 16%, while other types of distributed shock (such as neurogenic shock and anaphylactic shock) accounted for 4% and obstructive shock accounted for 2% (4). However, the current understanding of the incidence, etiology, and related prognosis of shock is limited. Most existing studies are single-center, have small samples based on specific patients (septic shock/cardiogenic shock) and are conducted in specific environments (ICU/emergency). These studies suggest limited value for understanding the etiology of the entire patient population. Therefore, clarifying the description and prognosis of shock-related diseases in the entire population can provide clinical decisions to address these potential shock patients. In this article, we used patient medical records from 31 provinces and cities in mainland China in 2018 to explains the epidemiology of shock, mortality of shock, and identify factors that related to hospital death. We present the following article in accordance with the STROBE reporting checklist (available at https://dx.doi.org/10.21037/atm-21-310).

Methods

Study design

This cross-sectional analysis was based on data abstracted from Hospital Quality Monitoring System (HQMS) in China, 2018. The system included 31 provinces, municipalities, and autonomous regions in China. In each region, all the three-level hospitals in the region's capital city and local hospitals from a smaller city or rural county were enrolled but did not include private hospitals or military hospitals.

Participants

Data were collected between January 1, 2018, and December 31, 2018. In order to avoid potential sources of bias, the study included all the tertiary hospital in China mainland. In China, hospitals are graded according to a 3-tier system that recognizes a hospital's ability to provide medical care and medical education and conduct medical research. Accordingly, hospitals are graded into primary, secondary or tertiary institutions. Tertiary hospitals are comprehensive or general hospitals at the city, provincial or

national level with a bed capacity exceeding 500. They are responsible for providing specialist health services and play a larger role in medical education and scientific research. They serve as medical hubs providing care to multiple regions. A total of 79,668,156 patients medical records from 1,064 tertiary hospitals (urban 79.21% *vs.* rural 20.79%) were included in this study.

Shock definition and classification

According to the characteristics of hemodynamics, shock can be divided into the following four categories: hypovolemic shock (from internal or external fluid loss), cardiogenic shock (e.g., acute myocardial infarction, end-stage cardiomyopathy, advanced valvular heart disease, myocarditis, or cardiac arrhythmias), obstructive shock (e.g., pulmonary embolism, cardiac tamponade, or tension pneumothorax), or distributive shock (e.g., septic shock, neurogenic shock or anaphylactic shock) (5). The most important component due to distributive shock is septic shock, while neurogenic shock was rare (n=88), and other subtypes of distributed shock were not recorded in the ICD-10. Therefore, this study used the ICD-10 code "A41.953-954" to define septic shock for statistical analysis.

Data sources and processing

The data come from the HQMS, a national database administrated by National Health Commission the PRC, which includes the following information: (I) demographic characteristic : gender, age, occupation, ethnicity, etc.; (II) patients' medical record: admission department, admission diagnosis, main discharge diagnosis, other discharge diagnosis, surgical operation, days of hospitalization, cost of hospitalization, method of leaving hospital, etc.; (III) hospital information: province, medical institution level, etc. The screening of patients with shock was based on ICD-10 codes and China National Standard: GB/T 14396-2016 Classification and codes of diseases for discharge diagnosis, including "A41.953-954", defined as septic shock; "R57.000", defined as cardiogenic shock; "R57.101", defined as hypovolemic shock; and "R57.801", defined as obstructive shock. Logic errors were eventually selected for analysis.

Outcome measures, exposure, and variables of interest

The main outcome of the study was in-hospital death according to the medical record. In addition to gender, age, admission diagnosis, and comorbidities, other relevant variables are admission department (including internal medicine, surgery, emergency department, ICU), and region (divided into northeastern, northern, eastern, southern, central, southwestern, and northwestern China), GDP (three levels of GDP per capita in the province where the hospital is located in 2018), length of hospital stay, and hospitalization cost. It is emphasized that the patient's concomitant disease is judged according to the ICD-10 code of the discharge diagnosis other than shock on the first page of the medical record. Like the discharge diagnosis, it is divided into the following 15 categories, as shown in Table S1.

Statistical analysis

Continuous variables were described as the mean ± standard deviation or median (quartile), and the frequency of variables (percentage) was used for classification variables. The missing data was defined as default value. The diagnosis rates of various comorbidities in shock patients were stratified by shock type and gender. In addition to calculations of the overall mortality rate of various shocks, the mortality rate of patients with other diseases was also calculated. The factors related to in-hospital death in shock patients were analyzed by multivariate logistic regression, and the OR values and 95% confidence intervals were calculated to find significant associations. The factors included in the analysis were gender, age, GDP, and comorbidities.

Ethical statement

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was authorized by the Office of Medical Administration of the National Health Commission of the PRC. The study was approved by the ethics committees of Peking Union Medical College Hospital (NO. S-K1297). All participating hospitals have approved by the ethics committees of the corresponding hospitals. All the individual consent for this retrospective analysis was waived.

Results

As shown in *Figure 1*, a total of 289,428 shock patients were included in this study. As shown in *Table 1*, the frequencies

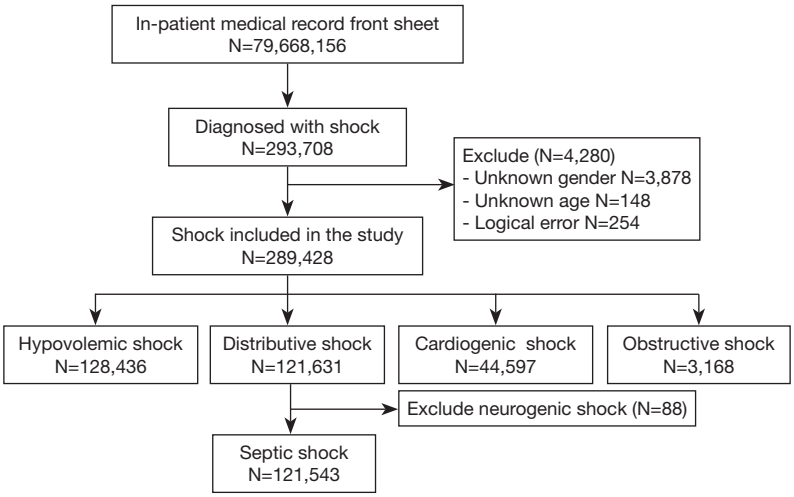

Figure 1 The flowchart of the patients involved in this study.

of shock according to the different causes of shock were as follows (the total ratio is greater than 100% due to mixed shock): 128,436 cases of hypovolemic shock, 121,543 cases of septic shock, 44,597 cases of cardiogenic shock, and 3,168 cases of obstructive shock. The majority of cases who suffered shock were men (61.7%). The mean age of the cases was 59.5±20.7 years. Among them, 62.2%, 56.5%, and 54% of cases with cardiogenic shock, obstructive shock, and septic shock were elderly. The cases with hypovolemic shock were mainly young and middle-aged (64.9%). Shock occurs less frequently in the total population among adolescents and children (4.4%). The main source of these cases was from medical admission (44.6%). According to ICD-10 codes recorded in HQMS, four shock-related frequency discharge diagnoses are classified: septic shock [symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (SSACL, 22.5%) > diseases of the respiratory system (DRS, 19.1%) > diseases of the digestive system (DDS, 18.7%)], cardiogenic shock [diseases of the circulatory system (DCS, 65.5%) > SSACL (14.9%)], hypovolemic shock [DDS (31.2%) > injury, poisoning and certain other consequences of external causes (IPEC, 22.2%) > DRS (17.7%) > DDS (15.6%)], and obstructive shock [SSACL (22.8%) > DRS (17.7%) > DDS (15.6%) > DCS (15.3%)]. Among cases with obstructive shock according to GDP, the proportion of patients with middle levels of GDP was the highest (43.8%), and the other three types of shock cases had the highest proportion of patients with high GDP levels (septic *vs.* cardiac *vs.* hypovolemic: 42% *vs.* 40.2% *vs.* 36.9%). The median length of hospital stay in septic shock was 11 days (4–20 days), that in cardiogenic shock was 6 days (1–13 days), that in hypovolemic shock was 9 days (4–18 days), and that in obstructive shock was 9 days (2–17 days). Septic shock accounts for the highest cost of hospitalization at 34,177.5 (14,953–76,239) yuan, and the hospitalization costs of the remaining three types of shock are equivalent [obstructive *vs.* cardiogenic *vs.* hypovolemic: 25,094.2 (10,797.5–55,144.8) *vs.* 23,682 (8399.5–55,924.2) *vs.* 21,775.9 (10,248.6–53,038.9) yuan]. In terms of mortality, cardiogenic shock had the highest mortality rate (31.6%), followed by obstructive shock (25.2%), distributed shock (22.4%), and hypovolemic shock (15.5%).

In addition, we divided the cases into two groups as single shock and mixed shock (as shown in Table S2). Cases with mixed shock accounted for 8147/289,428 (2.81%) of all shock patients. The description of mixed shock was shown as the Tables S3,S4. The majority of these population were older men (62%) and those with internal medicine diseases (44.4%), and the main discharge diagnoses were SSACL (20.6%) > DCS (16.9%) > DRS (15.9%) > DDS (14.8%). These people are mainly from the eastern (21.1%) and southwestern regions (20.7%) of China. Although the length of hospital stay is no longer than that of patients with a single type of shock [9 (3–20) *vs.* 9 (3–18) days], mixed shock incurs greater hospitalization costs [45,744 (17,431.6–113,108.9) *vs.* 26,114 (11,194.6–60,602) yuan] and has a higher mortality rate (37.7% *vs.* 19.9%).

Statistics on complication are shown in *Figure 2* and Tables S5-S8 for patients with different types of shock based on discharge diagnosis. Septic shock was mainly

Table 1 Basic characteristics of patients by types of shock

Characteristics	Total	Septic shock	Cardiogenic shock	Hypovolemic shock	Obstructive shock
No.	289,428	12,1543 (41.99)	44,597 (15.41)	128,436 (44.38)	3,168 (1.09)
Age, mean (SD), y	59.5 (20.7)	63.5 (20.4)	67.1 (17.1)	53.2 (20.3)	64.4 (19.2)
Age group, N (%)					
0–18	12,751 (4.4)	5,572 (4.6)	1,125 (2.5)	6,153 (4.8)	121 (3.8)
19–65	147,302 (50.9)	50,391 (41.4)	15,744 (35.3)	83,300 (64.9)	1,257 (39.7)
≥66	129,375 (44.7)	65,580 (54.0)	27,728 (62.2)	38,983 (30.3)	1,790 (56.5)
Gender, N (%)					
Male	178,431 (61.7)	73,862 (60.8)	26,772 (60.0)	81,088 (63.1)	1,857 (58.6)
Female	110,997 (38.3)	47,681 (39.2)	17,825 (40.0)	47,348 (36.9)	1,311 (41.4)
Ward of hospital admission, N (%)					
Medical	129,212 (44.6)	52,217 (43.0)	29,056 (65.1)	50,246 (39.1)	1,398 (44.1)
Surgical	79,653 (27.5)	31,184 (25.6)	2,611 (5.9)	46,801 (36.5)	642 (20.3)
Emergence	14,581 (5.1)	7,063 (5.8)	2,223 (5.0)	5,650 (4.4)	172 (5.4)
Intensive care unit	44,847 (15.5)	21,940 (18.1)	7,709 (17.3)	16,579 (12.9)	581 (18.4)
Other	10,145 (3.5)	4,374 (3.6)	1,269 (2.8)	4,515 (3.5)	254 (8.0)
Unknown	10,990 (3.8)	4,765 (3.9)	1,729 (3.9)	4,645 (3.6)	121 (3.8)
Primary diagnosis, N (%)					
IPD	7,581 (2.6)	6,245 (5.1)	269 (0.6)	1,242 (1.0)	101 (3.2)
Neoplasms	16,395 (5.7)	8,624 (7.1)	598 (1.3)	7,533 (5.9)	157 (5.0)
DBDIM	2,867 (1.0)	1,291 (1.1)	131 (0.3)	1,513 (1.2)	15 (0.5)
ENMD	4,974 (1.7)	2,944 (2.4)	652 (1.5)	1,611 (1.3)	51 (1.6)
DNS	2,279 (0.8)	1,518 (1.3)	239 (0.5)	567 (0.4)	27 (0.9)
DCS	44,380 (15.3)	9,608 (7.9)	29,200 (65.5)	6,506 (5.1)	485 (15.3)
DRS	29,481 (10.2)	23,158 (19.1)	2,975 (6.7)	4,115 (3.2)	562 (17.7)
DDS	63,055 (21.8)	22,737 (18.7)	1,011 (2.3)	40,043 (31.2)	495 (15.6)
DMSCT	2,027 (0.7)	1,270 (1.0)	216 (0.5)	613 (0.5)	23 (0.7)
DGS	11,166 (3.9)	7,205 (5.9)	920 (2.1)	3,212 (2.5)	161 (5.1)
PCP	9,539 (3.3)	2,89 (0.2)	37 (0.1)	9,239 (7.2)	9 (0.3)
COPP	1,127 (0.4)	8,83 (0.7)	58 (0.1)	169 (0.1)	25 (0.8)
SSACL	51,757 (17.9)	27,365 (22.5)	6,218 (13.9)	19,163 (14.9)	721 (22.8)
IPEC	32,324 (11.2)	3,541 (2.9)	719 (1.6)	28,488 (22.2)	136 (4.3)
FIHSCHS	3,452 (1.2)	1,597 (1.3)	251 (0.6)	1,660 (1.3)	38 (1.2)
Other	2,390 (0.8)	1,501 (1.2)	325 (0.7)	622 (0.5)	23 (0.7)
Unknown	4,634 (1.6)	1,767 (1.5)	778 (1.7)	2,140 (1.7)	139 (4.4)

Table 1 (*continued*)

Table 1 (*continued*)

Characteristics	Total	Septic shock	Cardiogenic shock	Hypovolemic shock	Obstructive shock
Region, N (%)					
Northeast	20,890 (7.2)	6,847 (5.6)	3,868 (8.7)	9,904 (7.7)	812 (25.6)
North	27,238 (9.4)	9,695 (8.0)	5,950 (13.3)	12,365 (9.6)	417 (13.2)
East	70,226 (24.3)	31,453 (25.9)	10,408 (23.3)	29,466 (23.0)	650 (20.5)
South	47,960 (16.6)	23,684 (19.5)	6,526 (14.6)	19,103 (14.9)	143 (4.5)
Centre	42,298 (14.6)	17,875 (14.7)	6,903 (15.5)	18,003 (14.0)	522 (16.5)
Northwest	21,713 (7.5)	8,461 (7.0)	3,011 (6.8)	10,438 (8.1)	415 (13.1)
Southwest	59,103 (20.4)	23,528 (19.3)	7,931 (17.8)	29,157 (22.7)	209 (6.6)
GDP, N (%)					
Tertile 1	113,636 (39.3)	51,018 (42.0)	17,930 (40.2)	47,345 (36.9)	783 (24.7)
Tertile 2	96,673 (33.4)	38,945 (32.0)	14,985 (33.6)	43,829 (34.1)	1,387 (43.8)
Tertile 3	79,119 (27.3)	31,580 (26.0)	11,682 (26.2)	37,262 (29.0)	998 (31.5)
Hospital stay, median (IQR), days	9 (3 to 18)	11 (4 to 20)	6 (1 to 13)	9 (4 to 18)	9 (2 to 17)
Hospital cost, median (IQR), RMB	26,496.1 (11,302.2 to 61,741.5)	34,177.5 (14,953.0 to 76,239.0)	23,682 (8,399.5 to 55,924.2)	21,775.9 (10,248.6 to 53,038.9)	25,094.2 (10,797.5 to 55,144.8)
Mortality, N (%)	58,957 (20.4)	27,255 (22.4)	14,112 (31.6)	19,939 (15.5)	798 (25.2)

IPD, infectious and parasitic disease; DBDIM, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism; ENMD, endocrine, nutritional and metabolic diseases; DNS, diseases of the nervous system; DCS, diseases of the circulatory system; DRS, diseases of the respiratory system; DDS, diseases of the digestive system; DMSCT, diseases of the musculoskeletal system and connective tissue; DGS, diseases of the genitourinary system; PCP, pregnancy, childbirth and the puerperium; COPP, certain conditions originating in the perinatal period; SSACL, symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified; IPEC, injury, poisoning and certain other consequences of external causes; FIHSCHS, factors influencing health status and contact with health services.

complicated with by respiratory diseases (70.86%), followed by endocrine (62.76%), circulatory (59.39%) and digestive (57.83%) conditions. For cardiogenic shock, DCS (97.99%) are predominantly diagnosed, followed by DRS (58.53%) and endocrine system (56.3%). For hypovolemic shock, the digestive system was the most frequency (57.34%), followed by the circulatory system (45.05%) and the endocrine system (42.8%). For obstructive shock, the respiratory system is dominant (66.86%), followed by the circulatory (66.76%) and endocrine systems (58.33%). The further classification of four shock-related frequency complication and shock severity were shown in the Tables S9-S13. In addition, we classified cases into those with single shock and those with mixed shock (as shown in Figure S1 and Tables S14,S15). Mixed shock can easily occur when the respiratory (77.51%), circulatory (73.97%), endocrine (69.29%) and digestive systems (63.23%) are all involved.

For the shock cases with other diagnoses (as shown in *Figure 3* and Tables S16-S19), case with malignant tumors had the highest mortality rate. The top three mortality rates for patients with complications were as follows: septic shock: neoplasms (31.77%) > SSACL (28.41%) > diseases of the nervous system (DNS, 28.38%); cardiogenic shock: neoplasms (45.68%) > diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (DBDIM, 38.03%) > diseases of the genitourinary system (DGS, 36.78%); hypovolemic shock: neoplasms (28.57%) > DNS (25.47%) > SSACL (25.34%); and obstructive shock: PCP (45.45%) > neoplasms (33.33%) > SSACL (30.72%). Shock is further divided into single shock and mixed shock (as shown in Figure S2 and Tables S20-S22). The top three frequencies for mortality in

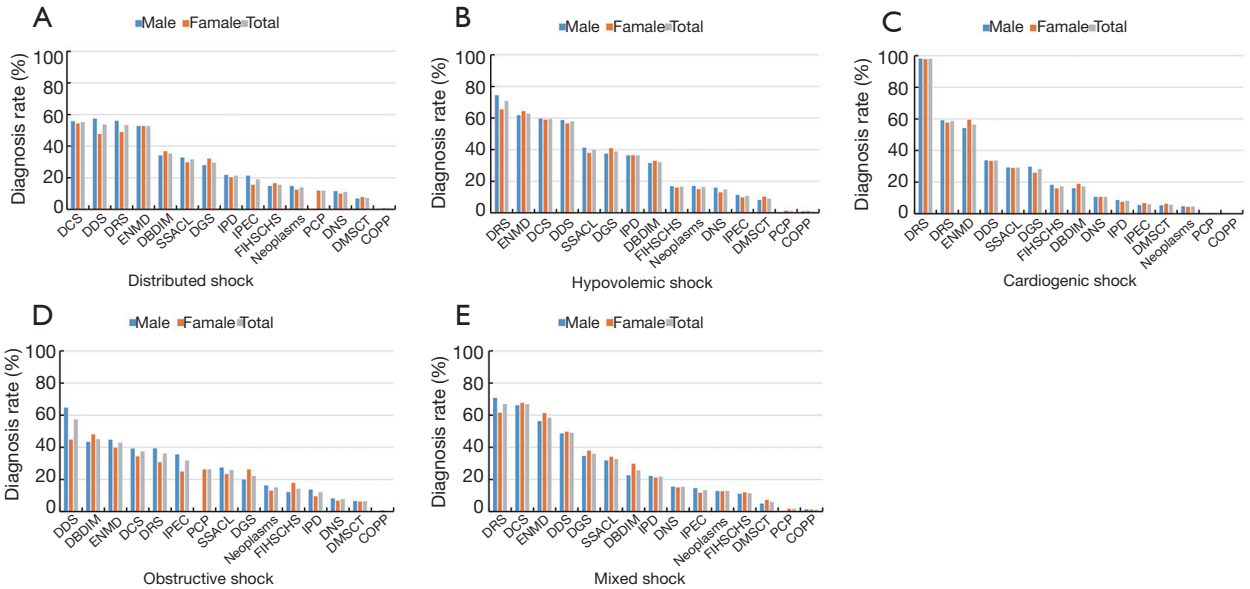

Figure 2 Diagnosis rate of various diagnoses in the shock patients. DCS, diseases of the circulatory system; DDS, diseases of the digestive system; DRS, diseases of the respiratory system; ENMD, endocrine, nutritional and metabolic diseases; DBDIM, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism; SSACL, symptoms, signs and abnormal clinical and laboratory; DGS, diseases of the genitourinary system; IPD, infectious and parasitic disease; IPEC, injury, poisoning and certain other consequences of external causes; FIHSCHS, Factors influencing health status and contact with health services; PCP, pregnancy, childbirth and the puerperium; DNS, diseases of the nervous system; DMSCT, diseases of the musculoskeletal system and connective tissue; DGS, diseases of the genitourinary system; COPP, certain conditions originating in the perinatal period.

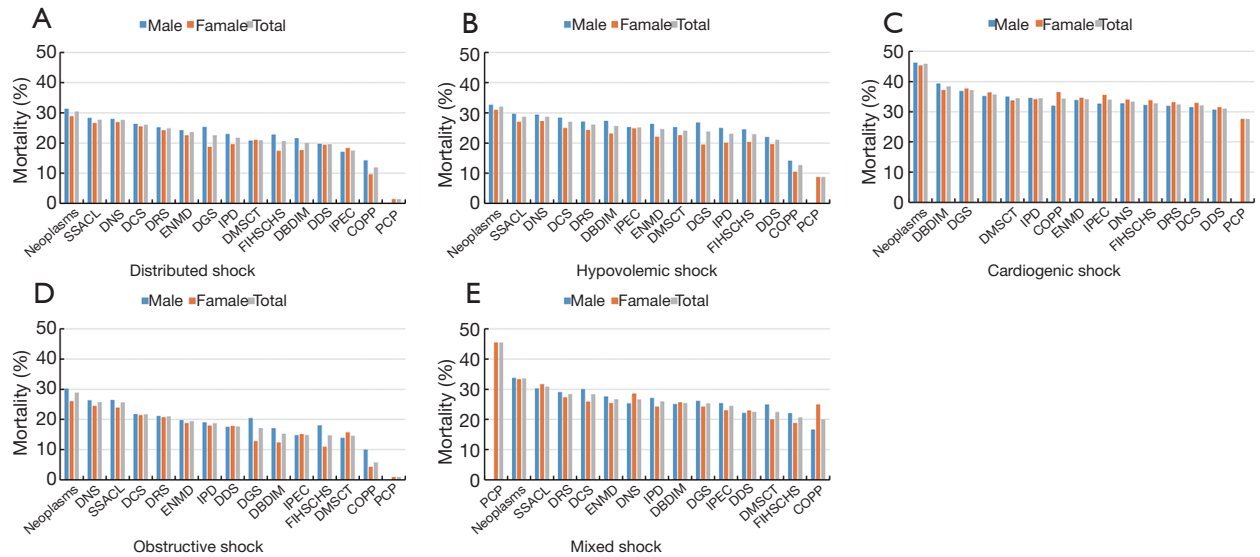

Figure 3 Diagnostic mortality in patients with shock. SSACL, symptoms, signs and abnormal clinical and laboratory; DNS, diseases of the nervous system; DCS, diseases of the circulatory system; DRS, diseases of the respiratory system; ENMD, endocrine, nutritional and metabolic diseases; DGS, diseases of the genitourinary system; IPD, infectious and parasitic disease; DMSCT, diseases of the musculoskeletal system and connective tissue; FIHSCHS, Factors influencing health status and contact with health services; DBDIM, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism; DDS, diseases of the digestive system; IPEC, injury, poisoning and certain other consequences of external causes; COPP, certain conditions originating in the perinatal period; PCP, pregnancy, childbirth and the puerperium.

Table 2 Risk factors for hospital death in patients with different type of shock

	Total			Septic shock			cardiogenic shock			Hypovolemic shock			obstructive shock		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age, y (*vs.* 0–10)															
0–20	1.05	0.94–1.17	0.4	1	0.84–1.18	0.97	1.15	0.87–1.51	0.34	1.29	1.10–1.53	0.002	1.42	0.41–4.86	0.58
21–30	1.01	0.92–1.11	0.84	1.22	1.06–1.40	0.005	0.96	0.74–1.23	0.72	1.13	0.98–1.31	0.09	1.09	0.40–2.94	0.87
31–40	1.17	1.08–1.27	<0.001	1.24	1.10–1.41	<0.001	0.81	0.65–1.00	0.05	1.5	1.31–1.71	<0.001	1.8	0.77–4.20	0.18
41–50	1.2	1.12–1.30	<0.001	1.11	0.99–1.24	0.06	0.88	0.73–1.06	0.18	1.61	1.42–1.83	<0.001	2.13	0.99–4.56	0.05
51–60	1.26	1.18–1.36	<0.001	1.04	0.93–1.15	0.5	0.98	0.82–1.16	0.78	1.79	1.58–2.03	<0.001	1.53	0.73–3.21	0.26
61–70	1.29	1.20–1.39	<0.001	1.04	0.94–1.15	0.46	1.01	0.86–1.20	0.88	1.87	1.65–2.12	<0.001	1.57	0.76–3.24	0.22
>70	2.01	1.87–2.15	<0.001	1.76	1.59–1.94	<0.001	1.51	1.28–1.78	<0.001	2.76	2.44–3.13	<0.001	2.75	1.34–5.63	0.006
Gender (female *vs.* male)	0.91	0.89–0.93	<0.001	0.86	0.83–0.88	<0.001	1.01	0.97–1.06	0.55	0.93	0.90–0.96	<0.001	0.92	0.77–1.09	0.32
GDP (*vs.* tertile 1)															
Tertile 2	0.94	0.91–0.96	<0.001	0.97	0.94–1.00	0.05	0.79	0.75–0.83	<0.001	0.96	0.92–0.99	0.02	1.3	1.05–1.61	0.02
Tertile 3	0.91	0.89–0.93	<0.001	0.97	0.94–1.00	0.08	0.81	0.77–0.85	<0.001	0.9	0.87–0.94	<0.001	1.13	0.89–1.42	0.32
Diagnosis															
IPD (yes *vs.* no)	0.95	0.92–0.97	<0.001	0.99	0.96–1.02	0.4	1.04	0.96–1.12	0.34	1.02	0.97–1.07	0.43	1.05	0.86–1.29	0.61
Neoplasms (yes *vs.* no)	2	1.95–2.05	<0.001	2.04	1.97–2.12	<0.001	1.75	1.60–1.92	<0.001	2.27	2.18–2.36	<0.001	1.81	1.43–2.29	<0.001
DBDIM (yes *vs.* no)	0.98	0.96–1.00	0.02	1.13	1.10–1.17	<0.001	1.24	1.17–1.31	<0.001	0.85	0.82–0.88	<0.001	0.96	0.79–1.17	0.7
ENMD (yes *vs.* no)	1.13	1.11–1.16	<0.001	1.12	1.09–1.16	<0.001	1.17	1.12–1.22	<0.001	1.1	1.06–1.14	<0.001	1.12	0.93–1.34	0.23
DNS (yes *vs.* no)	1.24	1.21–1.28	<0.001	1.22	1.17–1.26	<0.001	1	0.93–1.07	0.95	1.56	1.48–1.64	<0.001	0.96	0.77–1.21	0.75
DCS (yes *vs.* no)	1.63	1.59–1.66	<0.001	1.49	1.44–1.54	<0.001	1.14	0.98–1.33	0.09	1.33	1.28–1.37	<0.001	1.41	1.16–1.72	<0.001
DRS (yes *vs.* no)	1.21	1.19–1.24	<0.001	1.59	1.53–1.65	<0.001	0.9	0.86–0.94	<0.001	1.17	1.13–1.21	<0.001	1.43	1.18–1.74	<0.001
DDS (yes *vs.* no)	0.76	0.74–0.77	<0.001	0.8	0.78–0.83	<0.001	0.82	0.78–0.86	<0.001	0.94	0.91–0.98	0.002	0.79	0.66–0.94	0.006

Table 2 (*continued*)

Table 2 (*continued*)

	Total			Septic shock			cardiogenic shock			Hypovolemic shock			obstructive shock		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Diagnosis															
DMSCT (yes *vs.* no)	0.89	0.86 –0.92	<0.001	1.02	0.97 –1.07	0.47	1.02	0.94 –1.11	0.64	0.71	0.66 –0.76	<0.001	0.87	0.60 –1.25	0.44
DGS (yes *vs.* no)	1.02	0.99 –1.04	0.17	1.03	1.00 –1.06	0.03	1.26	1.20 –1.32	<0.001	0.97	0.93 –1.01	0.087	0.98	0.82 –1.17	0.78
PCP (yes *vs.* no)	0.13	0.11 –0.15	<0.001	0.63	0.47 –0.84	0.002	1.02	0.63 –1.66	0.94	0.12	0.10 –0.14	<0.001	5.33	1.97 –14.44	0.001
COPP (yes *vs.* no)	1.13	0.97 –1.33	0.12	1.07	0.88 –1.30	0.52	1.39	0.89 –2.16	0.14	1.32	0.89 –1.97	0.17	1.56	0.54 –4.49	0.41
SSACL (yes *vs.* no)	1.64	1.61 –1.67	<0.001	1.66	1.61 –1.71	<0.001	1.22	1.17 –1.28	<0.001	1.98	1.92 –2.05	<0.001	1.57	1.32 –1.87	<0.001
IPEC (yes *vs.* no)	1.04	1.01 –1.07	0.007	1.2	1.14 –1.25	<0.001	1.05	0.97 –1.15	0.25	1.18	1.13 –1.22	<0.001	1.05	0.82 –1.34	0.7
FIHSCHS (yes *vs.* no)	0.93	0.90 –0.95	<0.001	0.94	0.90 –0.97	<0.001	0.97	0.92 –1.02	0.27	0.85	0.81 –0.89	<0.001	0.67	0.51 –0.89	0.005

IPD, infectious and parasitic disease; DBDIM, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism; ENMD, endocrine, nutritional and metabolic diseases; DNS, diseases of the nervous system; DCS, diseases of the circulatory system; DRS, diseases of the respiratory system; DDS, diseases of the digestive system; DMSCT, diseases of the musculoskeletal system and connective tissue; DGS, diseases of the genitourinary system; PCP, pregnancy, childbirth and the puerperium; COPP, certain conditions originating in the perinatal period; SSACL, symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified; IPEC, injury, poisoning and certain other consequences of external causes; FIHSCHS, factors influencing health status and contact with health services.

these two shocks were as follows: single shock: neoplasms (29.98%) > SSACL (27.09%) > DNS (27.08%); mixed shock: neoplasms (46.35%) > SSACL (41.04%) > DGS (40.63%).

Table 2 describes the factors related to in-hospital deaths in patients with shock. Compared with patients aged 0-10 years, the risk of death in patients over the age of 30 years increased significantly The OR for patients aged 30 years and above ranged from 1.17 to 2.01. Among patients with cardiogenic shock and obstructive shock, elderly patients >70 years of age are at a higher risk of death. The risk of septic shock among patients between 21–40 years of age and >71 years of age is higher, indicating that younger and older age are the main risk factors for septic shock death. For different causes, it is interesting that from an economic perspective, the risk of death in obstructive shock is lower in economically developed regions than in economically underdeveloped regions, while the remaining three types of shock pose a higher risk of death in economically developed regions than in economically underdeveloped regions. Combining DDS (OR =0.8) and PCP (OR =0.64) have a lower mortality in septic shock. With neoplasms (OR =2.04) > SSACL (OR =1.66) > DRS (OR =1.59) > DCS (OR =1.49) > DNS (OR =1.22) > IPEC (OR =1.2) have a higher mortality rate. Regarding to cardiogenic shock, DDS (OR =0.82), while neoplasms (OR =1.75) > certain conditions originating in the perinatal period (COPP; OR =1.39) > DGS (OR =1.26) > DBDIM (OR =1.24) > SSACL (OR =1.22). The hypovolemic shock is DBDIM (OR =0.85) and FIHSCHS (OR =0.85), while neoplasms (OR =2.27) > SSACL (OR =1.98) > DNS (OR =1.56) > DCS (OR =1.33) > COPP (OR =1.32). The obstructive shock is FIHSCHS (OR =0.67) and DMSCT (OR =0.87), while PCP (OR =5.33) > neoplasms (OR =1.81) > SSACL (OR =1.57) > COPP (OR =1.56) > DRS (OR =1.43) > DCS (OR =1.41).

Cardiogenic shock had the highest mortality rate (31.6%), compared to other types of shock. We have further analyzed death composition and death risk associated with cardiogenic shock itself (Tables S23,S24), cardiogenic shock with septic shock (Tables S25,S26). Similar to the above analysis results,

it also shows that tumors are the most important risk factor for death in patients with cardiogenic shock.

Discussion

This study explored the relationship between related disease factors and the risk of death in shock patients through data from the HQMS in mainland China. Hypovolemic shock and septic shock were the most common types of shock, followed by cardiogenic shock; obstructive shock was the least common type. Septic shock patients accounted for the largest proportion of deaths among all shock patients, and cardiogenic shock had the highest mortality. In particular, we should note that shock in patients with malignant tumors is a higher risk factor for death.

Septic shock is an important clinical problem in critical care medicine and is the leading cause of death for patients in the ICU. The high incidence of sepsis accounts for 30% to 45% of critically ill patients (6). In recent years, the incidence has been rising due to the following factors: the increase in the elderly population in society; the widespread use of antibiotics, immunosuppressive agents, and invasive medical methods; the increase in the rate of antibiotic resistance; and the increased incidence of malignant tumors. Recently, Buchman *et al.* studied the sepsis among medicare beneficiaries during 2012–2018 and revealed that the burdens, trajectories, and forecasts of sepsis (7-9). Therefore, it is important to summarize the epidemiological data of septic shock in China to lay the foundation for the diagnosis and treatment of septic shock worldwide. Three epidemiological surveys of septic shock were conducted in China (10-12). However, these previous studies lack adequate organization, the samples are not representative, and the ICU was involved in only a limited capacity. Our study is the largest one in the world that describes shock and relevant diseases and provides guidance for the treatment and diagnosis of shock. This study fully explains the disease-related factors of shock. Additionally, one study published by Weng *et al.* in 2018 used data from the National Mortality Surveillance System, and they identified various infection deaths based on the ICD codes in the 2015 NMSS database (13). Sepsis-related deaths accounted for 12.6% of the 1,937,299 deaths reported by the database. Our data describe the clinical characteristics of septic shock in mainland China from another perspective. Septic shock was more likely to occur in young, middle-aged and elderly patients. In addition, septic shock occurred more frequently in areas with high GDP levels and in the eastern regions of China; this type of shock also involved long hospital stays and high costs. A combination of respiratory, endocrine, circulatory, and digestive diseases are often involved in septic shock. Malignant tumors, respiratory diseases, circulatory diseases, neurological diseases, and sources of injury and poisoning are independent risk factors for septic shock. The respiratory and circulatory systems are the first issues to be addressed in cases of septic shock.

CS is the leading cause of death in acute coronary syndromes (ACSs), which account for approximately 80% of CS cases (14). At present, the exact incidence of cardiogenic shock is difficult to determine, even if we know the characteristics of disease occurrence (15). In the past 15 years, the incidence of cardiogenic shock has increased from 4% to 8% in the ICU (16), and the mortality of cardiogenic shock has reached 50% (17). This study suggests that cardiogenic shock leads to the highest mortality rate in patients with shock, and it is prone to occur in elderly patients, especially those with cardiovascular, respiratory, and endocrine diseases. Patients with malignant tumors, blood immune system diseases and urogenital diseases may have a poor prognosis. Histories of tumors, pregnancy and diseases of the urinary, reproductive, hematological, and immune systems are risk factors for cardiogenic shock.

There is less epidemiological evidence of hypovolemic shock, mostly due to bleeding disorders or infectious diseases (18). Hypotension can be improved by blood transfusion, and hemodynamics can be easily stabilized by transfusion. The mortality rate is relatively low although the incidence of hypovolemic shock is high. Hypovolemic shock combined with digestive diseases is more common, but the prognosis is relatively good. A combination of malignant tumors, nervous system diseases, circulatory system diseases, and perinatal diseases are association for in-hospital death in these shock patients. For hypovolemic shock, timely differential diagnosis and etiology treatment are necessary.

The group of patients with the lowest incidence of shock were those with obstructive shock. It is mostly occurring in respiratory diseases and in middle-GDP areas in northeastern China. The mortality rate is only lower than that of cardiogenic shock and is higher than that of the other two types of shock. A significant number of patients with obstructive shock die due to pregnancy, which must be taken seriously. It is possible that amniotic fluid embolism is the cause of obstructive shock in these patients (19). For some low-GDP areas, the perinatal management of pregnant women should be emphasized.

This study has the following limitations. First, we used the ICD disease codes from the specific information of HQMS, named front page, but not from the patient's medical history. Chinese medical record management system is different from other countries. Each patient will form a front page after being discharged from the hospital. The front page of the inpatient medical record is a summary of the case data formed by the medical staff using words, symbols, codes, numbers, etc., which to refine the relevant information during the hospitalization of the patient in a specific table. We only analyzed the shock in the discharge diagnose. We cannot clearly determine the reasons and the timing leading to shock. Sometimes we did not differentiate the disease which source of shock or comorbidities. Second, this study only included 1,064 public tertiary hospitals, and no private secondary or military hospitals were included, which had a certain impact on the incidence and mortality of shock in the entire population. Third, Chinese medical policies are different from those in foreign countries; many patients may be admitted to multiple hospitals multiple times, and the home page of the medical record cannot reflect each previous visit. In addition, all data were anonymously encrypted, and we were unable to determine if multiple analyses were performed on the same patient. However, we speculated that the proportion of such patients is relatively small due to the China's large population base. Therefore, we calculated the cases number in this study.

This study is the first cross-sectional epidemiological survey on shock conducted using the HQMS of medical records based on a larger sample size. It has tremendous significance in clarifying the situation of shock and in the allocation and management of medical resources and supplements for understanding the incidence and death-related factors of each type of shock.

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Footnote

Reporting Checklist: The authors have completed the STROBE checklist., available at https://dx.doi.org/10.21037/atm-21-310

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://dx.doi.org/10.21037/atm-21-310). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work to ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was authorized by the Office of Medical Administration of the National Health Commission of the PRC. The study was approved by the ethics committees of Peking Union Medical College Hospital (NO. S-K1297). All participating hospitals have approved by the ethics committees of the corresponding hospitals. All the individual consent for this retrospective analysis was waived.

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Supplementary

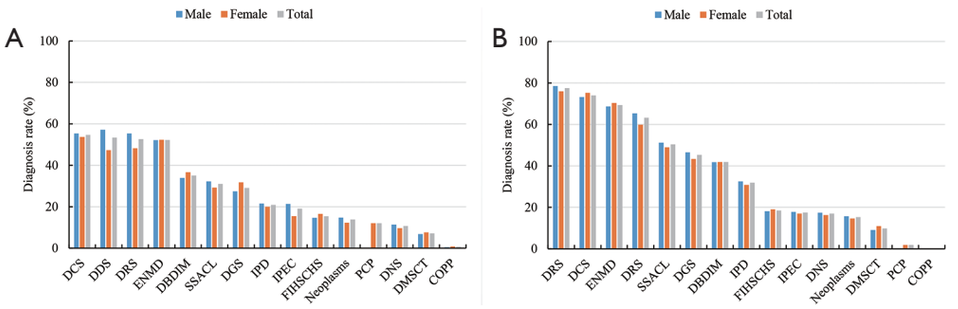

Figure S1 Diagnosis rate of various diagnoses in the single shock (A) or mixed shock (B).

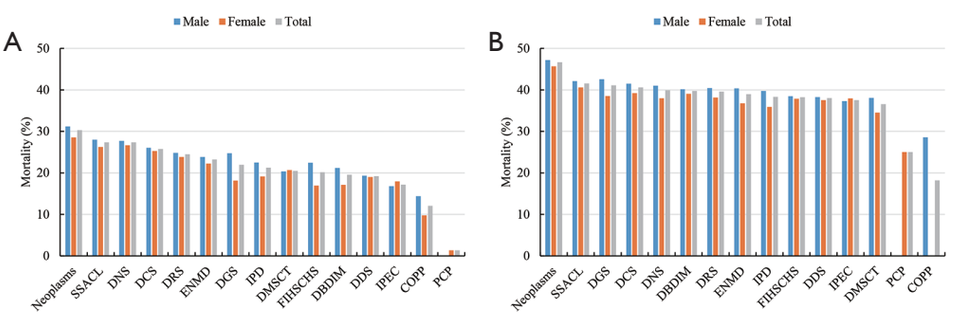

Figure S2 Diagnostic mortality in patients with single shock (A) or mixed shock (B).

Table S1 Fifteen categories and their abbreviation based in the ICD-10

Abbreviation	Disease	ICD-10 code
IPD	Certain infectious and parasitic disease	A00-B99
Neoplasms	Neoplasms	C00-D48
DBDIM	Diseases of the Blood and Blood-Forming Organs and Certain Disorders Involving the Immune Mechanism	D50-D89
ENMD	Endocrine, nutritional and metabolic diseases	E00-E90
DNS	Diseases of the nervous system	G00-G99
DCS	Diseases of the circulatory system	I00-I99
DRS	Diseases of the respiratory system	J00-J99
DDS	Diseases of the digestive system	K00-K99
DMSCT	Diseases of the musculoskeletal system and connective tissue	M00-M99
DGS	Diseases of the genitourinary system	N00-N99
PCP	Pregnancy, childbirth and the puerperium	O00-O99
COPP	Certain conditions originating in the perinatal period	P00-P96
SSACL	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	R00-R99
IPEC	Injury, poisoning and certain other consequences of external causes	S00-T98
FIHSCHS	Factors influencing health status and contact with health services	Z00-Z99

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Table S2 Characteristics of patients with single or mixed shock according to front page information

	Single Shock	Mixed Shock
No.	281281	8147
Age, mean (SD), y	59.3 (20.7)	65.1 (18.8)
Age group, N (%)		
0–18	12531 (4.4)	220 (2.7)
19–65	143978 (51.2)	3324 (40.8)
≥66	124772 (44.4)	4603 (56.5)
Gender, N (%)		
Male	173383 (61.6)	5048 (62.0)
Female	107898 (38.4)	3099 (38.0)
Ward of hospital admission, N (%)		
Male	125591 (44.6)	3621 (44.4)
Female	78089 (27.8)	1564 (19.2)
Male	14064 (5.0)	517 (6.3)
Female	42934 (15.3)	1913 (23.5)
Male	9880 (3.5)	265 (3.3)
Female	10723 (3.8)	267 (3.3)
Primary Diagnosis, N (%)		
IPD	7307 (2.6)	274 (3.4)
Neoplasms	15882 (5.7)	513 (6.3)
DBDIM	2784 (1.0)	83 (1.0)
ENMD	4699 (1.7)	275 (3.4)
DNS	2208 (0.8)	71 (0.9)
DCS	43000 (15.3)	1380 (16.9)
DRS	28187 (10.0)	1294 (15.9)
DDS	61847 (22.0)	1208 (14.8)
DMSCT	1936 (0.7)	91 (1.1)
DGS	10838 (3.9)	328 (4.0)
PCP	9504 (3.4)	35 (0.4)
COPP	1119 (0.4)	8 (0.1)
SSACL	50077 (17.8)	1680 (20.6)
IPEC	31772 (11.3)	552 (6.8)
FIHSCHS	3362 (1.2)	90 (1.1)
Other	2310 (0.8)	80 (1.0)
Unknown	4449 (1.6)	185 (2.3)
Region, N (%)		
Northeast	20364 (7.2)	526 (6.5)
North	26077 (9.3)	1161 (14.2)
East	68507 (24.4)	1719 (21.1)
South	46491 (16.5)	1469 (18)
Centre	41309 (14.7)	989 (12.1)
Northwest	21112 (7.5)	601 (7.4)
Southwest	57421 (20.4)	1682 (20.7)
GDP, N (%)		
Tertile 1	110251 (39.2)	3385 (41.6)
Tertile 2	94251 (33.5)	2422 (29.7)
Tertile 3	76779 (27.3)	2340 (28.7)
Hospital stay, median (IQR), days	9 (3 to 18)	9 (3 to 20)
Hospital cost, median (IQR), RMB	26114 (11194.6 to 60602.0)	45744 (17431.6 to 113108.9)
Mortality, N (%)	55887 (19.9)	3070 (37.7)

Table S2 (*continued*)

Table S2 (*continued*)

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Table S3 Types of mixed shock

Mixed shock	Cases numbers	Proportion (%)	Number of deaths	Mortality (%)
Septic shock + hypovolemic shock	4706	57.76	1546	32.85
Septic shock + cardiogenic shock	2388	29.31	1079	45.18
Cardiogenic shock + hypovolemic shock	605	7.43	260	42.98
Septic shock + cardiogenic shock + hypovolemic shock	142	1.74	68	47.89
Hypovolemic shock + obstructive shock	133	1.63	52	39.10
Septic shock + obstructive shock	78	0.96	28	35.90
Cardiogenic shock + obstructive shock	69	0.85	28	40.58
Septic shock + cardiogenic shock + obstructive shock	12	0.15	3	25.00
Cardiogenic shock + hypovolemic shock + obstructive shock	11	0.14	5	45.45
Septic shock + hypovolemic shock + obstructive shock	2	0.02	1	50.00
Septic shock + cardiogenic shock + hypovolemic shock + obstructive shock	1	0.01	0	0.00
Total	8187	100	3070	37.68

Table S4 Different shock types combined with other shock

	Cases numbers	Proportion (%)
Septic shock combined (N=121543)		
Hypovolemic shock	4851	3.99
Cardiogenic shock	2543	2.09
Obstructive shock	93	0.08
Cardiogenic shock combined (N=44597)		
Septic shock	2543	5.70
Hypovolemic shock	759	1.70
Obstructive shock	93	0.21
Hypovolemic shock combined (N=128436)		
Septic shock	4851	3.78
Cardiogenic shock	759	0.59
Obstructive shock	147	0.11
Obstructive shock combined (N=3168)		
Hypovolemic shock	147	4.64
Septic shock	93	2.94
Cardiogenic shock	93	2.94

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Table S5 Diagnosis rate of various diagnoses in septic shock patients (in descending order of total diagnosis rate)

Discharge diagnosis	Male			Female			Total		
	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)
DRS	54929	73862	74.37	31201	47681	65.44	86130	121543	70.86
ENMD	45635	73862	61.78	30648	47681	64.28	76283	121543	62.76
DCS	44069	73862	59.66	28117	47681	58.97	72186	121543	59.39
DDS	43342	73862	58.68	26950	47681	56.52	70292	121543	57.83
SSACL	30411	73862	41.17	18030	47681	37.81	48441	121543	39.86
DGS	27602	73862	37.37	19490	47681	40.88	47092	121543	38.75
IPD	26828	73862	36.32	17372	47681	36.43	44200	121543	36.37
DBDIM	23222	73862	31.44	15709	47681	32.95	38931	121543	32.03
FIHSCHS	12430	73862	16.83	7620	47681	15.98	20050	121543	16.5
Neoplasms	12548	73862	16.99	7130	47681	14.95	19678	121543	16.19
DNS	11746	73862	15.9	6190	47681	12.98	17936	121543	14.76
IPEC	8311	73862	11.25	4620	47681	9.69	12931	121543	10.64
DMSCT	5979	73862	8.09	4818	47681	10.1	10797	121543	8.88
PCP	-	-	-	613	47681	1.29	613	47681	1.29
COPP	725	73862	0.98	501	47681	1.05	1226	121543	1.01

Table S6 Diagnosis rate of various diagnoses in cardiogenic shock patients (in descending order of total diagnosis rate)

Discharge diagnosis	Male			Female			Total		
	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)
DCS	26267	26772	98.11	17433	17825	97.8	43700	44597	97.99
DRS	15830	26772	59.13	10273	17825	57.63	26103	44597	58.53
ENMD	14508	26772	54.19	10599	17825	59.46	25107	44597	56.3
DDS	9055	26772	33.82	5951	17825	33.39	15006	44597	33.65
SSACL	7840	26772	29.28	5165	17825	28.98	13005	44597	29.16
DGS	7955	26772	29.71	4622	17825	25.93	12577	44597	28.2
FIHSCHS	4890	26772	18.27	2848	17825	15.98	7738	44597	17.35
DBDIM	4326	26772	16.16	3370	17825	18.91	7696	44597	17.26
DNS	2861	26772	10.69	1897	17825	10.64	4758	44597	10.67
IPD	2309	26772	8.62	1331	17825	7.47	3640	44597	8.16
IPEC	1473	26772	5.5	1194	17825	6.7	2667	44597	5.98
DMSCT	1415	26772	5.29	1128	17825	6.33	2543	44597	5.7
Neoplasms	1263	26772	4.72	773	17825	4.34	2036	44597	4.57
PCP	-	-	-	90	17825	0.5	90	17825	0.5
COPP	52	26772	0.19	53	17825	0.3	105	44597	0.24

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Table S7 Diagnosis rate of various diagnoses in hypovolemic shock patients (in descending order of total diagnosis rate)

Discharge diagnosis	Male			Female			Total		
	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)
DDS	52407	81088	64.63	21232	47348	44.84	73639	128436	57.34
DBDIM	35110	81088	43.3	22751	47348	48.05	57861	128436	45.05
ENMD	36221	81088	44.67	18755	47348	39.61	54976	128436	42.8
DCS	31778	81088	39.19	16216	47348	34.25	47994	128436	37.37
DRS	31878	81088	39.31	14509	47348	30.64	46387	128436	36.12
IPEC	28791	81088	35.51	11809	47348	24.94	40600	128436	31.61
PCP	-	-	-	12375	47348	26.14	12375	47348	26.14
SSACL	22233	81088	27.42	10973	47348	23.18	33206	128436	25.85
DGS	16119	81088	19.88	12359	47348	26.1	28478	128436	22.17
Neoplasms	13123	81088	16.18	6133	47348	12.95	19256	128436	14.99
FIHSCHS	9816	81088	12.11	8425	47348	17.79	18241	128436	14.2
IPD	11069	81088	13.65	4489	47348	9.48	15558	128436	12.11
DNS	6614	81088	8.16	3179	47348	6.71	9793	128436	7.62
DMSCT	5289	81088	6.52	2927	47348	6.18	8216	128436	6.4
COPP	131	81088	0.16	378	47348	0.8	509	128436	0.4

Table S8 Diagnosis rate of various diagnoses in obstructive shock patients (in descending order of total diagnosis rate)

Discharge diagnosis	Male			Female			Total		
	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)
DRS	1313	1857	70.71	805	1311	61.4	2118	3168	66.86
DCS	1229	1857	66.18	886	1311	67.58	2115	3168	66.76
ENMD	1046	1857	56.33	802	1311	61.17	1848	3168	58.33
DDS	903	1857	48.63	652	1311	49.73	1555	3168	49.08
DGS	644	1857	34.68	496	1311	37.83	1140	3168	35.98
SSACL	589	1857	31.72	446	1311	34.02	1035	3168	32.67
DBDIM	419	1857	22.56	390	1311	29.75	809	3168	25.54
IPD	411	1857	22.13	277	1311	21.13	688	3168	21.72
DNS	288	1857	15.51	196	1311	14.95	484	3168	15.28
IPEC	269	1857	14.49	153	1311	11.67	422	3168	13.32
Neoplasms	236	1857	12.71	166	1311	12.66	402	3168	12.69
FIHSCHS	206	1857	11.09	156	1311	11.9	362	3168	11.43
DMSCT	92	1857	4.95	95	1311	7.25	187	3168	5.9
PCP	-	-	-	22	1311	1.68	22	1311	1.68
COPP	24	1857	1.29	16	1311	1.22	40	3168	1.26

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Table S9 The concomitant disease in patients with septic shock

Concomitant disease	Male		Female		Total	
	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)
Pulmonary infection	39877	57.54	22607	50.34	62484	54.71
Respiratory failure	25426	36.69	11983	26.68	37409	32.75
Septicemia	17366	25.06	12068	26.87	29434	25.77
Hypertension	17258	24.90	11858	26.41	29116	25.49
Heart failure	14480	20.89	9827	21.88	24307	21.28
Kidney failure	14694	21.20	8421	18.75	23115	20.24
Chronic heart disease	13568	19.58	8412	18.73	21980	19.24
Peritonitis	13092	18.89	8195	18.25	21287	18.64
Cerebrovascular disease	12803	18.47	6982	15.55	19785	17.32
Gastrointestinal disease	12053	17.39	7278	16.21	19331	16.93
Diabetes	10280	14.83	8191	18.24	18471	16.17
Malignant tumors	12038	17.37	6266	13.95	18304	16.03
MODS	10579	15.26	5915	13.17	16494	14.44
Arrhythmia	8644	12.47	5405	12.04	14049	12.30
Liver failure	8571	12.37	4390	9.78	12961	11.35
Organ hemorrhage	7781	11.23	2344	5.22	10125	8.86
Coagulopathy	6177	8.91	3896	8.68	10073	8.82
COPD	975	1.41	716	1.59	1691	1.48
Valvular heart disease	260	0.38	130	0.29	390	0.34
Burn	39877	57.54	22607	50.34	62484	54.71

Table S10 The concomitant disease in patients with cardiogenic shock

Concomitant disease	Male		Female		Total	
	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)
Acute cardiac event	17800	71.71	11155	67.41	28955	69.99
Chronic heart disease	16465	66.33	10431	63.04	26896	65.01
Heart failure	15147	61.02	10277	62.11	25424	61.46
Arrhythmia	9788	39.43	6626	40.04	16414	39.68
Hypertension	8903	35.87	6744	40.76	15647	37.82
Pulmonary infection	9296	37.45	6182	37.36	15478	37.41
Respiratory failure	5436	21.90	3548	21.44	8984	21.72
Diabetes	4881	19.66	3912	23.64	8793	21.26
Kidney failure	5044	20.32	3210	19.40	8254	19.95
Cerebrovascular disease	3977	16.02	2813	17.00	6790	16.41
Gastrointestinal disease	2356	9.49	1733	10.47	4089	9.88
COPD	2146	8.65	881	5.32	3027	7.32
Valvular heart disease	1306	5.26	1006	6.08	2312	5.59
Coagulopathy	999	4.02	701	4.24	1700	4.11
Malignant tumors	1058	4.26	567	3.43	1625	3.93
Septicemia	555	2.24	333	2.01	888	2.15
Peritonitis	370	1.49	304	1.84	674	1.63
Burn	12	0.05	12	0.07	24	0.06

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Table S11 The concomitant disease in patients with hypovolemic shock

Concomitant disease	Male		Female		Total	
	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)
Organ hemorrhage	35055	45.19	13427	29.67	48482	39.47
Pulmonary infection	15168	19.55	7169	15.84	22337	18.18
Liver failure	15081	19.44	5690	12.57	20771	16.91
Gastrointestinal disease	15215	19.61	4908	10.84	20123	16.38
Organ injury	14557	18.76	5083	11.23	19640	15.99
Hypertension	11960	15.42	6194	13.69	18154	14.78
Malignant tumors	12553	16.18	4794	10.59	17347	14.12
Fracture	11590	14.94	5037	11.13	16627	13.54
Chronic heart disease	7176	9.25	3952	8.73	11128	9.06
Respiratory failure	7242	9.34	3062	6.77	10304	8.39
Kidney failure	6880	8.87	3206	7.08	10086	8.21
Intracranial hemorrhage	7074	9.12	2931	6.48	10005	8.15
Postpartum hemorrhage	-	-	3179	7.02	3179	7.02
Coagulopathy	5213	6.72	3090	6.83	8303	6.76
Coagulopathy	4955	6.39	1984	4.38	6939	5.65
Burn	1803	2.32	853	1.88	2656	2.16
Septicemia	1629	2.10	792	1.75	2421	1.97

Table S12 The concomitant disease in patients with obstructive shock

Concomitant Disease	Male		Female		Total	
	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)	Cases numbers	Diagnosed (%)
Pulmonary infection	661	39.46	405	34.12	1066	37.25
Respiratory failure	572	34.15	349	29.40	921	32.18
Hypertension	360	21.49	310	26.12	670	23.41
Kidney failure	387	23.10	271	22.83	658	22.99
Chronic heart disease	369	22.03	287	24.18	656	22.92
Heart failure	337	20.12	236	19.88	573	20.02
Cerebrovascular disease	293	17.49	194	16.34	487	17.02
Gastrointestinal disease	257	15.34	184	15.50	441	15.41
Peritonitis	245	14.63	184	15.50	429	14.99
Pulmonary embolism	165	9.85	171	14.41	336	11.74
Septicemia	198	11.82	136	11.46	334	11.67
Malignant tumors	204	12.18	129	10.87	333	11.64
Arrhythmia	188	11.22	122	10.28	310	10.83
Diabetes	152	9.07	136	11.46	288	10.06
Acute cardiovascular events	159	9.49	126	10.61	285	9.96
COPD	166	9.91	65	5.48	231	8.07
Coagulopathy	94	5.61	86	7.25	180	6.29
Fracture	62	3.70	41	3.45	103	3.60
Aortic dissection	52	3.10	31	2.61	83	2.90
Valvular heart disease	21	1.25	21	1.77	42	1.47

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Table S13 Intervention of single types of shock

	Septic shock; (N=114214)	Cardiogenic shock (N=41369)	Hypovolemic shock (N=122836)	Obstructive shock (N=2862)
Invasive mechanical ventilation (IMV)	16460 (14.41)	5716 (13.82)	8062 (6.56)	200 (6.99)
IMV <96h	8007 (48.65)	3796 (66.41)	5421 (67.24)	122 (61.00)
IMV ≥96h	7924 (48.14)	1677 (29.34)	2467 (30.60)	77 (38.50)
Unknown	529 (3.21)	243 (4.25)	174 (2.16)	1 (0.50)
CRRT	4458 (3.90)	1477 (3.57)	1389 (1.13)	71 (2.48)
Coronary artery stenting	100 (0.09)	7444 (17.99)	179 (0.15)	4 (0.14)
Blood infusion	2129 (1.86)	418 (1.01)	4790 (3.90)	10 (0.35)
CPR	2321 (2.03)	2562 (6.19)	1938 (1.58)	44 (1.54)
Non-invasive mechanical ventilation	2293 (2.01)	1092 (2.64)	750 (0.61)	42 (1.47)
ECMO	260 (0.23)	442 (1.07)	36 (0.03)	9 (0.31)

Table S14 Diagnosis rate of various diagnoses in single shock patients (in descending order of total diagnosis rate)

Discharge diagnosis	Male			Female			Total		
	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)
DCS	95863	173383	55.29	57925	107898	53.68	153788	281281	54.67
DDS	99049	173383	57.13	51041	107898	47.3	150090	281281	53.36
DRS	95946	173383	55.34	52025	107898	48.22	147971	281281	52.61
ENMD	90404	173383	52.14	56388	107898	52.26	146792	281281	52.19
DBDIM	58811	173383	33.92	39597	107898	36.7	98408	281281	34.99
SSACL	55839	173383	32.21	31529	107898	29.22	87368	281281	31.06
DGS	47578	173383	27.44	34251	107898	31.74	81829	281281	29.09
IPD	37295	173383	21.51	21542	107898	19.97	58837	281281	20.92
IPEC	37035	173383	21.36	16709	107898	15.49	53744	281281	19.11
FIHSCHS	25487	173383	14.7	17859	107898	16.55	43346	281281	15.41
Neoplasms	25570	173383	14.75	13290	107898	12.32	38860	281281	13.82
PCP	-	-	-	12985	107898	12.03	12985	107898	12.03
DNS	19716	173383	11.37	10441	107898	9.68	30157	281281	10.72
DMSCT	11858	173383	6.84	8279	107898	7.67	20137	281281	7.16
COPP	918	173383	0.53	940	107898	0.87	1858	281281	0.66

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Table S15 Diagnosis rate of various diagnoses in mixed shock patients (in descending order of total diagnosis rate)

Discharge diagnosis	Male			Female			Total		
	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)	Patient numbers	Total numbers	Diagnosed (%)
DRS	3960	5048	78.45	2355	3099	75.99	6315	8147	77.51
DCS	3694	5048	73.18	2332	3099	75.25	6026	8147	73.97
DBDIM	3466	5048	68.66	2179	3099	70.31	5645	8147	69.29
DDS	3296	5048	65.29	1855	3099	59.86	5151	8147	63.23
SSACL	2585	5048	51.21	1518	3099	48.98	4103	8147	50.36
DGS	2347	5048	46.49	1342	3099	43.3	3689	8147	45.28
DBDIM	2109	5048	41.78	1297	3099	41.85	3406	8147	41.81
IPD	1643	5048	32.55	954	3099	30.78	2597	8147	31.88
FIHSCHS	916	5048	18.15	589	3099	19.01	1505	8147	18.47
IPEC	899	5048	17.81	526	3099	16.97	1425	8147	17.49
DNS	880	5048	17.43	503	3099	16.23	1383	8147	16.98
Neoplasms	793	5048	15.71	452	3099	14.59	1245	8147	15.28
DMSCT	455	5048	9.01	340	3099	10.97	795	8147	9.76
PCP	-	-	-	57	3099	1.84	57	3099	1.84
COPP	7	5048	0.14	4	3099	0.13	11	8147	0.14

Table S16 Diagnostic mortality in patients with septic shock (in descending order of total mortality)

Discharge diagnosis	Male			Female			Total		
	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)
Neoplasms	4061	12548	32.36	2190	7130	30.72	6251	19678	31.77
SSACL	8935	30411	29.38	4829	18030	26.78	13764	48441	28.41
DNS	3418	11746	29.1	1673	6190	27.03	5091	17936	28.38
DCS	12399	44069	28.14	6966	28117	24.78	19365	72186	26.83
DRS	14753	54929	26.86	7515	31201	24.09	22268	86130	25.85
DBDIM	6296	23222	27.11	3601	15709	22.92	9897	38931	25.42
IPEC	2079	8311	25.02	1141	4620	24.7	3220	12931	24.9
ENMD	11922	45635	26.12	6720	30648	21.93	18642	76283	24.44
DMSCT	1500	5979	25.09	1081	4818	22.44	2581	10797	23.9
DGS	7337	27602	26.58	3767	19490	19.33	11104	47092	23.58
IPD	6619	26828	24.67	3452	17372	19.87	10071	44200	22.79
FIHSCHS	3023	12430	24.32	1541	7620	20.22	4564	20050	22.76
DDS	9428	43342	21.75	5241	26950	19.45	14669	70292	20.87
COPP	101	725	13.93	52	501	10.38	153	1226	12.48
PCP	-	-	-	53	613	8.65	53	613	8.65

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Table S17 Diagnostic mortality in patients with cardiogenic shock (in descending order of total mortality)

Discharge diagnosis	Male			Female			Total		
	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)
Neoplasms	581	1263	46	349	773	45.15	930	2036	45.68
DBDIM	1688	4326	39.02	1239	3370	36.77	2927	7696	38.03
DGS	2906	7955	36.53	1720	4622	37.21	4626	12577	36.78
SSACL	2730	7840	34.82	1860	5165	36.01	4590	13005	35.29
DMSCT	490	1415	34.63	378	1128	33.51	868	2543	34.13
IPD	791	2309	34.26	451	1331	33.88	1242	3640	34.12
PCP	4859	14508	33.49	3636	10599	34.31	8495	25107	33.84
ENMD	476	1473	32.32	420	1194	35.18	896	2667	33.6
IPEC	16	52	30.77	19	53	35.85	35	105	33.33
DNS	928	2861	32.44	640	1897	33.74	1568	4758	32.96
FIHSCHS	1566	4890	32.02	957	2848	33.6	2523	7738	32.61
DRS	4995	15830	31.55	3376	10273	32.86	8371	26103	32.07
DCS	8177	26267	31.13	5683	17433	32.6	13860	43700	31.72
DDS	2756	9055	30.44	1859	5951	31.24	4615	15006	30.75
COPP	-	-	-	24	90	26.67	24	90	26.67

Table S18 Diagnostic mortality in patients with hypovolemic shock (in descending order of total mortality)

Discharge diagnosis	Male			Female			Total		
	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)
Neoplasms	3919	13123	29.86	1583	6133	25.81	5502	19256	28.57
DNS	1724	6614	26.07	770	3179	24.22	2494	9793	25.47
SSACL	5821	22233	26.18	2595	10973	23.65	8416	33206	25.34
DCS	6854	31778	21.57	3444	16216	21.24	10298	47994	21.46
DRS	6662	31878	20.9	2975	14509	20.5	9637	46387	20.78
ENMD	7113	36221	19.64	3487	18755	18.59	10600	54976	19.28
IPD	2085	11069	18.84	796	4489	17.73	2881	15558	18.52
DDS	9107	52407	17.38	3752	21232	17.67	12859	73639	17.46
DGS	3259	16119	20.22	1575	12359	12.74	4834	28478	16.97
DBDIM	5941	35110	16.92	2794	22751	12.28	8735	57861	15.1
IPEC	4203	28791	14.6	1769	11809	14.98	5972	40600	14.71
FIHSCHS	1750	9816	17.83	917	8425	10.88	2667	18241	14.62
DMSCT	727	5289	13.75	457	2927	15.61	1184	8216	14.41
PCP	13	131	9.92	16	378	4.23	29	509	5.7
COPP	-	-	-	116	12375	0.94	116	12375	0.94

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Table S19 Diagnostic mortality in patients with obstructive shock (in descending order of total mortality)

Discharge diagnosis	Male			Female			Total		
	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)
PCP	-	-	-	10	22	45.45	10	22	45.45
Neoplasms	79	236	33.47	55	166	33.13	134	402	33.33
SSACL	178	589	30.22	140	446	31.39	318	1035	30.72
DRS	380	1313	28.94	219	805	27.2	599	2118	28.28
DCS	368	1229	29.94	228	886	25.73	596	2115	28.18
ENMD	73	288	25.35	56	196	28.57	129	484	26.65
DNS	288	1046	27.53	203	802	25.31	491	1848	26.57
IPD	111	411	27.01	67	277	24.19	178	688	25.87
DBDIM	105	419	25.06	100	390	25.64	205	809	25.34
DGS	168	644	26.09	120	496	24.19	288	1140	25.26
IPEC	68	269	25.28	35	153	22.88	103	422	24.41
DDS	23	92	25	19	95	20	42	187	22.46
DMSCT	200	903	22.15	149	652	22.85	349	1555	22.44
FIHSCHS	45	206	21.84	29	156	18.59	74	362	20.44
PCP	4	24	16.67	4	16	25	8	40	20

Table S20 Risk factors for hospital death in patients with different type of shock

	Total			Septic Shock			cardiogenic shock			Hypovolemic shock			obstructive shock		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Age, y (*vs.* 0–10)															
0–20	1.05	0.94–1.17	0.4	1	0.84–1.18	0.97	1.15	0.87–1.51	0.34	1.29	1.10–1.53	0.002	1.42	0.41–4.86	0.58
21–30	1.01	0.92–1.11	0.84	1.22	1.06–1.40	0.005	0.96	0.74–1.23	0.72	1.13	0.98–1.31	0.09	1.09	0.40–2.94	0.87
31–40	1.17	1.08–1.27	<0.001	1.24	1.10–1.41	<0.001	0.81	0.65–1.00	0.05	1.5	1.31–1.71	<0.001	1.8	0.77–4.20	0.18
41–50	1.2	1.12–1.30	<0.001	1.11	0.99–1.24	0.06	0.88	0.73–1.06	0.18	1.61	1.42–1.83	<0.001	2.13	0.99–4.56	0.05
51–60	1.26	1.18–1.36	<0.001	1.04	0.93–1.15	0.5	0.98	0.82–1.16	0.78	1.79	1.58–2.03	<0.001	1.53	0.73–3.21	0.26
61–70	1.29	1.20–1.39	<0.001	1.04	0.94–1.15	0.46	1.01	0.86–1.20	0.88	1.87	1.65–2.12	<0.001	1.57	0.76–3.24	0.22
>70	2.01	1.87–2.15	<0.001	1.76	1.59–1.94	<0.001	1.51	1.28–1.78	<0.001	2.76	2.44–3.13	<0.001	2.75	1.34–5.63	0.006
Gender (Female *vs.* Male)	0.91	0.89–0.93	<0.001	0.86	0.83–0.88	<0.001	1.01	0.97–1.06	0.55	0.93	0.90–0.96	<0.001	0.92	0.77–1.09	0.32
GDP (*vs.* Tertile 1)															
Tertile 2	0.94	0.91–0.96	<0.001	0.97	0.94–1.00	0.05	0.79	0.75–0.83	<0.001	0.96	0.92–0.99	0.02	1.3	1.05–1.61	0.02
Tertile 3	0.91	0.89–0.93	<0.001	0.97	0.94–1.00	0.08	0.81	0.77–0.85	<0.001	0.9	0.87–0.94	<0.001	1.13	0.89–1.42	0.32

Table S20 (*continued*)

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Table S20 (*continued*)

	Total			Septic Shock			cardiogenic shock			Hypovolemic shock			obstructive shock		
	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Discharge Diagnosis															
IPD (yes *vs.* no)	0.95	0.92–0.97	<0.001	0.99	0.96–1.02	0.4	1.04	0.96–1.12	0.34	1.02	0.97–1.07	0.43	1.05	0.86–1.29	0.61
Neoplasms (yes *vs.* no)	2	1.95–2.05	<0.001	2.04	1.97–2.12	<0.001	1.75	1.60–1.92	<0.001	2.27	2.18–2.36	<0.001	1.81	1.43–2.29	<0.001
DBDIM (yes *vs.* no)	0.98	0.96–1.00	0.02	1.13	1.10–1.17	<0.001	1.24	1.17–1.31	<0.001	0.85	0.82–0.88	<0.001	0.96	0.79–1.17	0.7
ENMD (yes *vs.* no)	1.13	1.11–1.16	<0.001	1.12	1.09–1.16	<0.001	1.17	1.12–1.22	<0.001	1.1	1.06–1.14	<0.001	1.12	0.93–1.34	0.23
DNS (yes *vs.* no)	1.24	1.21–1.28	<0.001	1.22	1.17–1.26	<0.001	1	0.93–1.07	0.95	1.56	1.48–1.64	<0.001	0.96	0.77–1.21	0.75
DCS (yes *vs.* no)	1.63	1.59–1.66	<0.001	1.49	1.44–1.54	<0.001	1.14	0.98–1.33	0.09	1.33	1.28–1.37	<0.001	1.41	1.16–1.72	<0.001
DRS (yes *vs.* no)	1.21	1.19–1.24	<0.001	1.59	1.53–1.65	<0.001	0.9	0.86–0.94	<0.001	1.17	1.13–1.21	<0.001	1.43	1.18–1.74	<0.001
DDS (yes *vs.* no)	0.76	0.74–0.77	<0.001	0.8	0.78–0.83	<0.001	0.82	0.78–0.86	<0.001	0.94	0.91–0.98	0.002	0.79	0.66–0.94	0.006
DMSCT (yes *vs.* no)	0.89	0.86–0.92	<0.001	1.02	0.97–1.07	0.47	1.02	0.94–1.11	0.64	0.71	0.66–0.76	<0.001	0.87	0.60–1.25	0.44
DGS (yes *vs.* no)	1.02	0.99–1.04	0.17	1.03	1.00–1.06	0.03	1.26	1.20–1.32	<0.001	0.97	0.93–1.01	0.087	0.98	0.82–1.17	0.78
PCP (yes *vs.* no)	0.13	0.11–0.15	<0.001	0.63	0.47–0.84	0.002	1.02	0.63–1.66	0.94	0.12	0.10–0.14	<0.001	5.33	1.97–14.44	0.001
COPP (yes *vs.* no)	1.13	0.97–1.33	0.12	1.07	0.88–1.30	0.52	1.39	0.89–2.16	0.14	1.32	0.89–1.97	0.17	1.56	0.54–4.49	0.41
SSACL (yes *vs.* no)	1.64	1.61–1.67	<0.001	1.66	1.61–1.71	<0.001	1.22	1.17–1.28	<0.001	1.98	1.92–2.05	<0.001	1.57	1.32–1.87	<0.001
IPEC (yes *vs.* no)	1.04	1.01–1.07	0.007	1.2	1.14–1.25	<0.001	1.05	0.97–1.15	0.25	1.18	1.13–1.22	<0.001	1.05	0.82–1.34	0.7
FIHSCHS (yes *vs.* no)	0.93	0.90–0.95	<0.001	0.94	0.90–0.97	<0.001	0.97	0.92–1.02	0.27	0.85	0.81–0.89	<0.001	0.67	0.51–0.89	0.005

Table S21 Diagnostic mortality in patients with single shock (in descending order of total mortality)

Discharge diagnosis	Male			Female			Total		
	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)
Neoplasms	7891	25570	30.86	3759	13290	28.28	11650	38860	29.98
SSACL	15477	55839	27.72	8189	31529	25.97	23666	87368	27.09
DNS	5409	19716	27.43	2758	10441	26.42	8167	30157	27.08
DCSS	24719	95863	25.79	14488	57925	25.01	39207	153788	25.49
DRS	23579	95946	24.58	12284	52025	23.61	35863	147971	24.24
ENMD	21377	90404	23.65	12437	56388	22.06	33814	146792	23.04
DGS	11666	47578	24.52	6149	34251	17.95	17815	81829	21.77
IPD	8299	37295	22.25	4080	21542	18.94	12379	58837	21.04
DMSCT	2391	11858	20.16	1699	8279	20.52	4090	20137	20.31
FIHSCHS	5673	25487	22.26	2995	17859	16.77	8668	43346	20
DBDIM	12331	58811	20.97	6717	39597	16.96	19048	98408	19.36
DDS	18958	99049	19.14	9607	51041	18.82	28565	150090	19.03
IPEC	6156	37035	16.62	2964	16709	17.74	9120	53744	16.97
PCP	130	918	14.16	91	940	9.68	221	1858	11.89
COPP	-	-	-	174	12985	1.34	174	12985	1.34

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Table S22 Diagnostic mortality in patients with mixed shock (in descending order of total mortality)

Discharge diagnosis	Male			Female			Total		
	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)	Number of deaths	Number of diagnoses	Mortality (%)
Neoplasms	371	793	46.78	206	452	45.58	577	1245	46.35
SSACL	1076	2585	41.62	608	1518	40.05	1684	4103	41.04
DGS	989	2347	42.14	510	1342	38	1499	3689	40.63
DCS	1516	3694	41.04	904	2332	38.77	2420	6026	40.16
DNS	358	880	40.68	188	503	37.38	546	1383	39.48
DBDIM	838	2109	39.73	501	1297	38.63	1339	3406	39.31
DRS	1584	3960	40	890	2355	37.79	2474	6315	39.18
ENMD	1384	3466	39.93	793	2179	36.39	2177	5645	38.57
IPD	350	916	38.21	222	589	37.69	572	1505	38.01
FIHSCHS	644	1643	39.2	340	954	35.64	984	2597	37.89
DDS	1249	3296	37.89	689	1855	37.14	1938	5151	37.62
IPEC	333	899	37.04	198	526	37.64	531	1425	37.26
DMSCT	172	455	37.8	116	340	34.12	288	795	36.23
COPP	-	-	-	14	57	24.56	14	57	24.56
PCP	2	7	28.57	0	4	0	2	11	18.18

Table S23 Mortality of various complications in patients with cardiogenic shock

Comorbidity	Male		Female		Total	
	Number of diagnoses	Number of diagnoses [Mortality (%)]	Number of diagnoses	Number of diagnoses [Mortality (%)]	Number of diagnoses	Number of diagnoses [Mortality (%)]
Coagulopathy	999	432 (43.24)	701	305 (43.51)	1700	737 (43.35)
Malignant tumors	1058	460 (43.48)	567	243 (42.86)	1625	703 (43.26)
Kidney failure	5044	1975 (39.16)	3210	1266 (39.44)	8254	3241 (39.27)
Respiratory failure	5436	2041 (37.55)	3548	1384 (39.01)	8984	3425 (38.12)
Diabetes	4881	1831 (37.51)	3912	1497 (38.27)	8793	3328 (37.85)
Septicemia	555	207 (37.30)	333	111 (33.33)	888	318 (35.81)
Hypertension	8903	3084 (34.64)	6744	2457 (36.43)	15647	5541 (35.41)
Cerebrovascular disease	3977	1375 (34.57)	2813	1002 (35.62)	6790	2377 (35.01)
Burn	12	4 (33.33)	12	4 (33.33)	24	8 (33.33)
Acute cardiovascular events	17800	5657 (31.78)	11155	3885 (34.83)	28955	9542 (32.95)
Chronic heart disease	16465	5008 (30.42)	10431	3428 (32.86)	26896	8436 (31.37)
Heart failure	15147	4615 (30.47)	10277	3344 (32.54)	25424	7959 (31.31)
Valvular heart disease	1306	395 (30.25)	1006	326 (32.41)	2312	721 (31.19)
Peritonitis	370	115 (31.08)	304	92 (30.26)	674	207 (30.71)
Arrhythmia	9788	2872 (29.34)	6626	2041 (30.80)	16414	4913 (29.93)
Pulmonary infection	9296	2735 (29.42)	6182	1895 (30.65)	15478	4630 (29.91)
COPD	2146	589 (27.45)	881	233 (26.45)	3027	822 (27.16)
Gastrointestinal disease	2356	601 (25.51)	1733	438 (25.27)	4089	1039 (25.41)

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Table S24 Analysis of risk factors for death in patients with cardiogenic shock

Factors	OR	95% CI	P
Age (ref=0–10)			
11–20	1.01	0.76, 1.35	0.9437
21–30	0.82	0.63, 1.06	0.1265
31–40	0.67	0.54, 0.83	0.0003
41–50	0.71	0.59, 0.85	0.0002
51–60	0.75	0.63, 0.89	0.0009
61–70	0.75	0.63, 0.88	0.0007
≥71	1.11	0.94, 1.31	0.2168
Gender (female vs. male)	1.04	0.99, 1.08	0.1325
GDP (ref=high)			
mid	0.86	0.82, 0.91	<0.0001
low	0.85	0.80, 0.89	<0.0001
Malignant tumors	1.90	1.71, 2.11	<0.0001
Coagulopathy	1.62	1.46, 1.80	<0.0001
Respiratory failure	1.53	1.45, 1.61	<0.0001
Acute cardiovascular events	1.45	1.38, 1.52	<0.0001
Kidney failure	1.44	1.37, 1.52	<0.0001
Diabetes	1.34	1.27, 1.41	<0.0001
Hypertension	1.19	1.13, 1.24	<0.0001
Septicemia	1.18	1.02, 1.37	0.0247
Cerebrovascular disease	1.13	1.07, 1.20	<0.0001
Valvular heart disease	1.12	1.02, 1.23	0.0222
Chronic heart disease	1.05	1.00, 1.10	0.0583
Peritonitis	1.04	0.88, 1.24	0.6378
Heart failure	1.02	0.98, 1.07	0.3752
Burn	0.98	0.41, 2.36	0.9671
Arrhythmia	0.96	0.92, 1.00	0.0715
Pulmonary infection	0.78	0.74, 0.81	<0.0001
Gastrointestinal disease	0.75	0.70, 0.81	<0.0001
COPD	0.74	0.67, 0.80	<0.0001

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Table S25 Mortality rate of comorbidity in patients with cardiogenic shock combined septic shock

Comorbidity	Male		Female		Total	
	Number of diagnoses	Number of diagnoses [Mortality (%)]	Number of diagnoses	Number of diagnoses [Mortality (%)]	Number of diagnoses	Number of diagnoses [Mortality (%)]
Malignant tumors	126	73 (57.94)	79	44 (55.70)	205	117 (57.07)
Diabetes	349	198 (56.73)	221	108 (48.87)	570	306 (53.68)
Cerebrovascular disease	326	171 (52.45)	204	110 (53.92)	530	281 (53.02)
Kidney failure	623	333 (53.45)	338	168 (49.70)	961	501 (52.13)
Hypertension	536	272 (50.75)	312	156 (50.00)	848	428 (50.47)
Coagulopathy	255	131 (51.37)	162	78 (48.15)	417	209 (50.12)
Septicemia	578	298 (51.56)	375	179 (47.73)	953	477 (50.05)
Gastrointestinal disease	160	72 (45.00)	104	59 (56.73)	264	131 (49.62)
MODS	409	205 (50.12)	223	108 (48.43)	632	313 (49.53)
Organ hemorrhage	174	82 (47.13)	108	57 (52.78)	282	139 (49.29)
Arrhythmia	520	253 (48.65)	340	166 (48.82)	860	419 (48.72)
Acute cardiovascular events	752	372 (49.47)	459	213 (46.41)	1211	585 (48.31)
Respiratory failure	825	400 (48.48)	460	219 (47.61)	1285	619 (48.17)
Chronic heart disease	818	392 (47.92)	488	235 (48.16)	1306	627 (48.01)
Liver failure	267	131 (49.06)	163	70 (42.94)	430	201 (46.74)
Pulmonary infection	1069	505 (47.24)	692	299 (43.21)	1761	804 (45.66)
Heart failure	881	395 (44.84)	559	246 (44.01)	1440	641 (44.51)
Valvular heart disease	89	37 (41.57)	55	27 (49.09)	144	64 (44.44)
COPD	233	102 (43.78)	78	30 (38.46)	311	132 (42.44)
Peritonitis	124	50 (40.32)	87	38 (43.68)	211	88 (41.71)
Burn	3	0 (0.00)	1	1 (100.00)	4	1 (25.00)

Table S26 Analysis of risk factors of death in patients with cardiogenic shock combined with septic shock

Factors	OR	95% CI	P
Age (ref=0–10)			
11–20	2.92	0.95, 8.91	0.0605
21–30	1.25	0.48, 3.29	0.6522
31–40	0.82	0.34, 2.00	0.6620
41–50	1.10	0.50, 2.44	0.8148
51–60	1.30	0.62, 2.75	0.4914
61–70	1.14	0.55, 2.38	0.7267
≥71	1.79	0.87, 3.71	0.1159
Gender (female *vs.* male)	0.95	0.80, 1.13	0.5867
GDP (ref=high)			
Mid	0.67	0.54, 0.83	0.0002
Low	0.80	0.65, 0.98	0.0328
Malignant tumors	1.74	1.28, 2.35	0.0004
Diabetes	1.41	1.14, 1.73	0.0012
Kidney failure	1.38	1.15, 1.66	0.0006
MODS	1.37	1.13, 1.66	0.0017
Respiratory failure	1.27	1.06, 1.51	0.0087
Chronic heart disease	1.23	1.02, 1.47	0.0278
Septicemia	1.21	1.01, 1.44	0.0346
Cerebrovascular disease	1.18	0.96, 1.46	0.1252
Arrhythmia	1.16	0.97, 1.39	0.1146
Acute cardiovascular events	1.15	0.97, 1.37	0.1112
Gastrointestinal disease	1.11	0.85, 1.47	0.4437
Coagulopathy	1.10	0.87, 1.39	0.4438
Organ hemorrhage	1.06	0.82, 1.38	0.6627
Hypertension	1.01	0.84, 1.22	0.9154
Valvular heart disease	0.98	0.69, 1.41	0.9204
Liver failure	0.97	0.77, 1.23	0.8177
Pulmonary infection	0.93	0.76, 1.14	0.4823
Peritonitis	0.83	0.60, 1.13	0.2269
Heart failure	0.81	0.67, 0.97	0.0188
COPD	0.80	0.62, 1.05	0.1061
Burn	0.47	0.05, 4.59	0.5141

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