

Original Article

Comparing the demographic data and outcomes of septic shock patients presenting to teaching or non-teaching metropolitan hospitals in the United States

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BACKGROUND: Studies looking at the effect of hospital teaching status on septic shock related in-hospital mortality are lacking. The aim of this study was to examine the effect of hospital teaching status on mortality in septic shock patients in the United States.

METHODS: This was a retrospective observational study, using the Nationwide Emergency Department Sample Database (released in 2018). All patients with septic shock were included. Complex sample logistic regression was performed to assess the impact of hospital teaching status on patient mortality.

RESULTS: A total of 388,552 septic shock patients were included in the study. The average age was 66.93 years and 51.7% were males. Most of the patients presented to metropolitan teaching hospitals (68.2%) and 31.8% presented to metropolitan non-teaching hospitals. Septic shock patients presenting to teaching hospitals were found to have a higher percentage of medical comorbidities, were more likely to be intubated and placed on mechanical ventilation (50.5% vs. 46.9%) and had a longer average length of hospital stay (12.47 d vs. 10.20 d). Septic shock patients presenting to teaching hospitals had greater odds of in-hospital mortality compared to those presenting to metropolitan non-teaching hospitals (adjusted odd ratio [OR]=1.295, 95% confidence interval [CI]: 1.256–1.335).

CONCLUSION: Septic shock patients presenting to metropolitan teaching hospitals had significantly higher risks of mortality than those presenting to metropolitan non-teaching hospitals. They also had higher rates of intubation and mechanical ventilation as well as longer lengths of hospital stay than those in non-teaching hospitals.

KEYWORDS: Sepsis; Septic shock; In-hospital mortality; Hospital teaching status; United States; Epidemiology; Outcome

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INTRODUCTION

Sepsis is a public health burden and the most prevalent disease among intensive care unit (ICU) admissions.^[1] Its incidence and prevalence have been gradually increasing over the years.^[1] Sepsis also poses an important financial burden on the healthcare system; it accounts for 13% of hospitalization costs in the United States.^[2] Moreover, sepsis patients who survive their ICU stay are at higher risk of immune system dysregulation, recurrent admissions and decreased quality of life.^[1] The overall mortality rate of

septic shock in the United States was 34.2% in 2018, with a median hospital length of stay reaching 16.5 d.^[3,4] Similar numbers were also reported in Europe, where 10.4% of ICU admissions were attributed to septic shock, with a 28-day mortality reaching 36.7%.^[5] Older age, medical comorbidities and an Acute Physiological Assessment and Chronic Health Evaluation (APACHE) score greater than 25 were associated with increased mortality in septic shock patients.^[6-9] Several studies have shown that better outcomes in septic shock patients are due to early

diagnosis and antibiotic use.^[10-12]

Previous studies have examined the association between hospital teaching status and hospital mortality. Burke et al^[13] found that teaching hospitals in the United States had significantly lower 30-day mortality rates than non-teaching hospitals. This was thought to be due to a higher level of medical expertise, availability of advanced technology and optimization of the staff's duty hours.^[13,14] These results were particularly more evident in pneumonia, acute coronary syndrome (ACS) and congestive heart failure patients.^[15-17]

Given the lack of studies assessing the effect of hospital teaching status on septic shock-related mortality, the aim of this study was to examine the association between hospital teaching status and in-hospital mortality in septic shock patients in the United States.

METHODS

Study design

This was a retrospective observational study, using the 2016 Nationwide Emergency Department Sample (NEDS) Database, which was released in 2018. It is the largest validated database across the United States, containing over 30 million yearly emergency department (ED) visits.^[18] It was developed for the Agency for Healthcare Research and Quality (AHRQ), Healthcare Cost and Utilization Project (HCUP).^[18] The database includes ED visits from over 953 hospitals in 36 different states (686 hospitals were metropolitans) and the District of Columbia amounting to a total of 144,842,742 weighted ED visits.^[19] To generate nationwide estimates, weights were created using the AHA survey of hospitals as the standard. These weights were used to obtain national and encounter level estimates for approximately 144 million ED visits in the NEDS 2016 database.^[18] All contributing authors to this study finished the online HCUP Data Use Agreement training course and signed the agreement. An exemption for research using the de-identified database has been granted by the institutional review board of the American University of Beirut. Sepsis was defined according to the Sepsis-3 guidelines.^[20] All septic shock patients who were 18 years of age or above, who were admitted to a metropolitan hospital, were included in the study. Patients below the age of 18 years or with an unrecorded age or who presented to non-metropolitan or rural hospitals or with an ED disposition other than admitted, died, or transferred (home health care, against medical advice, not admitted/destination unknown, discharge alive/destination unknown but not

admitted) were excluded. ICD-10 CM code R65.21 was used to identify septic shock patients. While selecting the study sample, we considered all diagnoses and not only the first diagnosis. Septic shock patients were divided into two groups: those who presented to a metropolitan teaching hospital and those who presented to metropolitan non-teaching hospital. A teaching hospital is defined as a hospital that has a residency program approved by the American Medical Association (AMA) and is part of the Council of Teaching Hospitals (COTH) or if the ratio of full-time residents to beds is at least 0.25 based on the AHA Annual Survey Database.^[18] A hospital was defined as metropolitan or non-metropolitan based on the county in which it is located. Urban Influence Codes (UICs) were used to categorize hospitals as metropolitan or non-metropolitan. Chronic medical conditions were identified using ICD-10 CM coding. The variables included in the analysis of our study were patient demographics, chronic conditions, hospital teaching status, length of stay, ED and hospital procedures, disposition and outcomes. The variable of interest was hospital teaching status. The primary outcome was hospital mortality.

Data abstraction

The Healthcare Cost and Utilization Project (HCUP-US) is a family of healthcare databases developed through a Federal-State-Industry partnership. HCUP databases bring together the data collection efforts of hospitals, private data organizations and state data organizations. Quality review is checked by conducting descriptive analyses for all data elements and is implemented by an independent contractor for each year and data source. The validity of the numeric data is verified by checking their range against legal values/standard norms/maximum allowed value. The validity of the character data is assessed by verifying them against norms when feasible (e.g., diagnosis codes and procedure codes). Internal inconsistencies were assessed by comparing the values of related data elements. For example, a hysterectomy procedure should be performed for females and not for males. The admission date should fall before the discharge date.^[18] The following link provides detailed information about the HCUP quality control procedures: <https://www.hcup-us.ahrq.gov/db/quality.pdf>.

Statistical analysis

Descriptive analyses of the demographics, administrative and clinical characteristics were reported as the mean and 95% confidence interval (CI) for the

continuous variables and as frequencies, percentages, and 95% *CI* for the categorical variables. Some analyses were verified and confirmed by using a free online query system based on data from HCUP (HCUPnet). The Rao-Scott Chi-square test, a modified version of Pearson's Chi-square test, and a general linear model for complex samples were used to compare the proportion of the categorical variables and the mean age between the two groups of patients (teaching vs. non-teaching). Binary logistic regression is not an accurate multivariate analysis for data abstracted from the NEDS database that was collected using complex survey sampling designs. Therefore, to avoid committing a type I error and producing biased estimates, a complex samples logistic regression model was performed by including all statistically and clinically significant variables. The following variables were imposed on the model: hospital teaching status; age; indicator of sex; infectious and parasitic disease; neoplasms; endocrine, nutritional, and metabolic diseases and immunity disorders; diseases of blood and blood-forming organs; diseases of the circulatory system; diseases of the respiratory system; diseases of the digestive system; diseases of the skin and subcutaneous tissue; region of hospital; average length of stay; hospital procedures (small bowel resection; colorectal resection; appendectomy; fluoroscopy of the biliary and pancreatic ducts; cholecystectomy and common duct exploration; laparoscopy [GI only]; exploratory laparotomy; other non-operative upper GI therapeutic procedures; other operative upper GI therapeutic procedures; other non-operative lower GI therapeutic procedures; other operative lower GI therapeutic procedures; other GI diagnostic procedures; other non-operative GI therapeutic procedures; other operative GI therapeutic procedures and respiratory intubation and mechanical ventilation).

A *P*-value of ≤ 0.05 was used to indicate statistical significance. All statistical analyses were performed using SPSS version 24.0 (IBM Corp., USA).

RESULTS

A total of 388,552 septic shock patients were included in the study (Figure 1). The average age was 66.93 (95% *CI*: 66.84–67.03) years, and 51.7% were males. The majority of patients presented to a metropolitan teaching hospital (68.2%), and 31.8% presented to a metropolitan non-teaching hospital. The most common comorbid conditions were a history of infectious and parasitic disease (97.8%), endocrine,

nutritional and immune disorders (92.9%), diseases of the circulatory system (87.5%), diseases of the genitourinary system (84.1%), diseases of the respiratory system (79.9%) and diseases of blood and blood-forming organs (63.3%). The average length of hospital stay was 11.76 d (95% *CI*: 11.67–11.84 d). A total of 31% of septic shock patients ($n=120,602$) died during their hospital stay (Table 1).

A total of 43.7% and 3.1% of septic shock patients underwent minor and major diagnostic procedures, respectively. A total of 83.1% and 19.1% underwent minor and major therapeutic procedures, respectively. A total of 49.4% of the septic shock patients were intubated and were mechanically ventilated during their hospital stay (Table 2).

Patients presenting to a metropolitan non-teaching hospital were older (68.01 years vs. 66.43 years, $P<0.001$). There was no significant difference in gender based on hospital teaching status (51.4% males in non-teaching hospitals vs. 51.8% in teaching hospitals, $P=0.190$). Patients presenting to a metropolitan teaching hospital were found to have higher rates of malignancy (18.7% vs. 16.6%, $P<0.001$), endocrine, nutritional and immune disorders (93.0% vs. 92.7%, $P=0.029$), diseases of the respiratory system (80.1% vs. 79.3%, $P=0.003$), diseases of blood and blood forming organs (63.8% vs. 62.1%, $P<0.001$), diseases of the digestive system (58.4% vs. 56.4%, $P<0.001$) and diseases of the skin and subcutaneous tissue (24.9% vs. 22.0%, $P<0.001$).

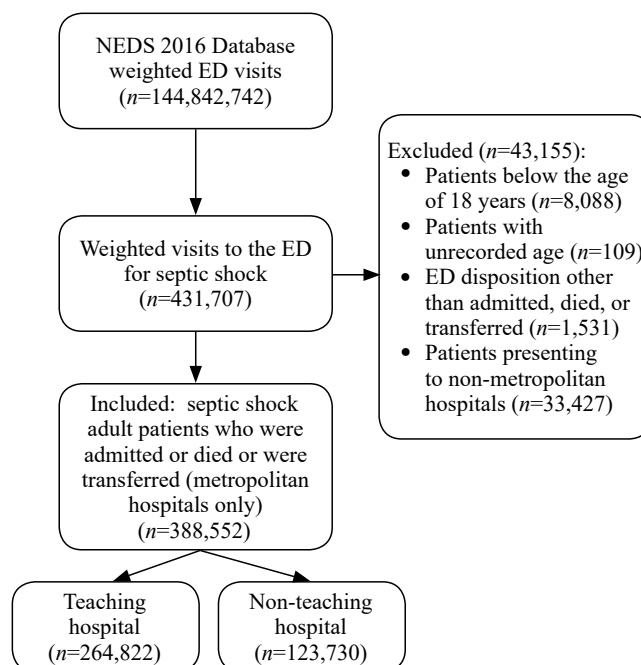


Figure 1. Inclusion and exclusion flowchart. ED: emergency department.

Table 1. The characteristics and disposition of the septic shock patients presenting to the emergency department

Variables	Frequency/mean (n=388,552)	Percentage (95%CI)/ 95%CI alone
Gender		
Male	200,662	51.7 (51.4–52.0)
Female	187,746	48.3 (48.0–48.6)
Missing = 144 (0.01%)		
Average age of patients, years	66.93	66.84–67.03
Past medical history		
History of infectious and parasitic disease	380,129	97.8 (97.7–97.9)
Malignancy	70,087	18.0 (17.8–18.3)
Endocrine, nutritional, metabolic diseases and immunity disorders	360,963	92.9 (92.7–93.0)
Diseases of blood and blood-forming organs	245,795	63.3 (63.0–63.5)
Psychiatric disorders	183,053	47.1 (46.8–47.4)
Diseases of the nervous system	224,667	57.8 (57.5–58.1)
Diseases of the circulatory system	339,981	87.5 (87.3–87.7)
Diseases of the respiratory system	310,263	79.9 (79.6–80.1)
Diseases of the digestive system	224,493	57.8 (57.5–58.1)
Diseases of the genitourinary system	326,819	84.1 (83.9–84.3)
Diseases of the skin and subcutaneous tissue	93,019	23.9 (23.7–24.2)
Diseases of the musculoskeletal system	118,864	30.6 (30.3–30.9)
Region of the hospital		
Northeast	76,219	19.6 (19.6–19.6)
Midwest	74,802	19.3 (19.3–19.3)
South	148,958	38.3 (38.3–38.3)
West	88,573	22.8 (22.8–22.8)
Teaching status of hospital		
Metropolitan non-teaching	123,731	31.8 (31.8–31.8)
Metropolitan teaching	264,821	68.2 (68.2–68.2)
Disposition of patient from emergency department		
Transfer to another short-term hospital	2,414	0.6 (0.6–0.7)
Other transfers (including skilled nursing facility, intermediate care, and another type of facility)	635	0.2 (0.1–0.2)
Admitted as an inpatient to this hospital	383,372	98.7 (98.6–98.7)
Died in emergency department	2,131	0.5 (0.5–0.6)
Disposition of patient from hospital		
Discharged home	64,363	16.8 (16.6–17.0)
Transfer to short-term hospital	15,557	4.1 (3.9–4.2)
Other transfers (including skilled nursing facility, intermediate care, and another type of facility)	133,917	34.9 (34.7–35.2)
Home health care	47,893	12.5 (12.3–12.7)
Against medical advice	2,988	0.8 (0.7–0.8)
Deceased	118,471	30.9 (30.6–31.2)
Discharged alive with unknown destination	59	0 (0–0)
Missing= 5,304 (1.4%)		
In-hospital mortality		
No	267,950	69.0 (68.7–69.2)
Yes	120,602	31.0 (30.8–31.3)
Average length of stay, d	11.76	11.67–11.84

Table 2. Procedures undergone by the septic shock patients

Procedures	Frequency (n=383,372)	Percentage (95%CI)
Procedure class for inpatient procedure		
Minor diagnostic	167,559	43.7 (43.4–44.0)
Minor therapeutic	318,419	83.1 (82.8–83.3)
Major diagnostic	11,771	3.1 (3.0–3.2)
Major therapeutic	73,161	19.1 (18.9–19.3)
Hospital procedures		
Small bowel resection	1,153	0.3 (0.3–0.3)
Colorectal resection	7,879	2.1 (2.0–2.1)
Appendectomy	1,929	0.5 (0.5–0.5)
Fluoroscopy of the biliary and pancreatic ducts (ERCP, ERC and ERP)	1,640	0.4 (0.4–0.5)
Cholecystectomy and common duct exploration	3,937	1.0 (1.0–1.1)
Laparoscopy (GI only)	1,538	0.4 (0.4–0.4)
Exploratory laparotomy	1,660	0.4 (0.4–0.5)
Other non-operative upper GI therapeutic procedures	12,487	3.3 (3.2–3.4)
Other operative upper GI therapeutic procedures	5,944	1.6 (1.5–1.6)
Other non-operative lower GI therapeutic procedures	2,522	0.7 (0.6–0.7)
Other operative lower GI therapeutic procedures	9,635	2.5 (2.4–2.6)
Other gastrointestinal diagnostic procedures	8,720	2.3 (2.2–2.4)
Other non-operative gastrointestinal therapeutic procedures	11,843	3.1 (3.0–3.2)
Other operative gastrointestinal therapeutic procedures	9,393	2.5 (2.4–2.5)
Respiratory intubation and mechanical ventilation	189,311	49.4 (49.1–49.7)

ERCP: endoscopic retrograde cholangiopancreatography; ERC: endoscopic retrograde cholangiography; ERP: endoscopic retrograde pancreatography; GI: gastrointestinal.

Respiratory intubation and mechanical ventilation rates among septic shock patients were higher in metropolitan teaching hospitals (50.5% vs. 46.9%, $P < 0.001$). Exploratory laparotomy (0.5% vs. 0.3%, $P < 0.001$) and all non-surgical gastrointestinal procedures (7.5% vs. 5.9%) were significantly higher in the metropolitan teaching hospitals. However, small bowel resection (0.4% vs. 0.3%, $P < 0.001$), appendectomy (0.6% vs. 0.4%, $P < 0.001$) and cholecystectomy (1.3% vs. 0.9%, $P < 0.001$) were significantly higher in the metropolitan non-teaching hospitals. The average length of hospital stay was significantly longer in metropolitan teaching hospitals (12.47 d vs. 10.20 d, $P < 0.001$). Hospital mortality was significantly higher in metropolitan teaching hospitals (32.4% vs. 28.1%, $P < 0.001$) (Table 3).

After adjusting for confounders, septic shock patients presenting to metropolitan teaching hospitals had greater odds of in-hospital mortality than patients presenting to metropolitan non-teaching hospitals (adjusted $OR = 1.295$, 95% CI : 1.256–1.335, $P < 0.001$) (Table 4).

DISCUSSION

This study examined the relationship between hospital teaching status and in-hospital mortality in septic shock patients using the 2016 NEDS database. In-hospital mortality was found to be significantly higher in teaching hospitals than in non-teaching hospitals. After adjusting for confounders, septic shock patients presenting to metropolitan teaching hospitals had higher odds of mortality compared to metropolitan non-teaching hospitals. Furthermore, septic shock patients presenting to teaching hospitals were found to have a higher percentage of medical comorbidities, were more likely to be intubated or placed on mechanical ventilation and had a longer hospital length of stay.

Septic shock treatment evolved over time. It was first centered around early goal-directed therapy (EGDT), which was resource dependent and invasive involving the use of central venous catheters, arterial lines and blood transfusions.^[21,22] Three randomized clinical trials have showed that EGDT was not better than standard care (consisting of early identification and early antibiotic administration).^[10-12] Their findings were corroborated later by a meta-analysis.^[22] Studies performed between 2016 and 2020 also recommended the administration of vasopressors via a peripheral line, further reducing the need for central venous catheters.^[23-26] Given this switch to less invasive and less resource dependent

care, one would expect no difference in septic shock-related mortality between teaching and non-teaching metropolitan hospitals.

The literature showed that acute coronary syndrome, pneumonia and heart failure patients presenting to teaching hospitals have lower mortality.^[15-17] This finding was attributed to the greater expertise of treating teams in teaching hospitals as well as the greater availability of advanced technology and higher medical resident to patient ratio.^[13,17] There is a scarcity of evidence examining the association between septic shock mortality and hospital teaching status. One study showed a higher mortality rate for septic shock patients in teaching hospitals. This was explained by the higher severity of sepsis cases in teaching hospitals.^[27]

Several reasons can explain why septic shock patients had greater odds of mortality in teaching hospitals. Khwannimit et al^[7] showed that patients who presented to teaching hospitals were more likely to have chronic medical conditions and increased odds of hospital mortality. Furthermore, another study showed that there was a correlation between the number of medical comorbidities and septic shock related in-hospital mortality.^[28]

Another potential explanation for the higher mortality in teaching hospitals is the higher intubation rate and mechanical ventilation in septic shock patients. Mechanical ventilation can predispose patients to lung injury as well as ventilator associated pneumonia (VAP). Delbove et al^[29] showed that among sepsis patients, those who were intubated had a higher mortality rate than those who were not intubated. Furthermore, patients who developed VAP had a higher mortality rate and longer ICU stay.^[30,31]

We found that septic shock patients presenting to metropolitan teaching hospitals had more comorbidities at baseline and higher intubation rates during their hospital stay. This might indicate that they were sicker or were more complicated to manage medically. In addition, they had a longer length of hospital stay, which can increase the patients' risk of hospital acquired infection and further increase their morbidity. The above factors could have contributed to the higher odds of in-hospital mortality in metropolitan teaching hospitals.

Limitations

This study is limited by its retrospective design. The generalizability to other populations could be limited by the fact that the database only includes hospitals in

Table 3. The characteristics, disposition and hospital procedures of the septic shock patients presenting to the emergency department based on hospital teaching status

Variables	Metropolitan non-teaching hospital		Metropolitan teaching hospital		P-value
	Frequency (n=123,730)	Percentage (95%CI) or mean (95%CI)	Frequency (n=264,822)	Percentage (95%CI) or mean (95%CI)	
Gender					
Male	63,547	51.4 (50.9–51.9)	137,115	51.8 (51.4–52.2)	0.190
Female	60,141	48.6 (48.1–49.1)	127,605	48.2 (47.8–48.6)	
Average age, years	123,730	68.01 (67.86–68.17)	264,822	66.43 (66.32–66.54)	<0.001
Past medical history					
History infectious or parasitic disease	120,664	97.5 (97.4–97.7)	259,465	98.0 (97.9–98.1)	<0.001
Malignancy	20,564	16.6 (16.2–17.0)	49,523	18.7 (18.4–19.0)	<0.001
Endocrine, nutritional, metabolic diseases and immunity disorders	114,645	92.7 (92.4–92.9)	246,317	93.0 (92.8–93.2)	0.029
Diseases of blood and blood-forming organs	76,852	62.1 (61.6–62.6)	168,943	63.8 (63.5–64.1)	<0.001
Psychiatric disorders	58,635	47.4 (46.9–47.9)	124,418	47.0 (46.6–47.3)	0.201
Diseases of the nervous system	71,340	57.7 (57.1–58.2)	153,327	57.9 (57.5–58.2)	0.444
Diseases of the circulatory system	108,627	87.8 (87.5–88.1)	231,354	87.4 (87.1–87.6)	0.042
Diseases of the respiratory system	98,163	79.3 (78.9–79.8)	212,100	80.1 (79.8–80.4)	0.003
Diseases of the digestive system	69,771	56.4 (55.9–56.9)	154,721	58.4 (58.1–58.8)	<0.001
Diseases of the genitourinary system	103,844	83.9 (83.5–84.3)	222,976	84.2 (83.9–84.5)	0.249
Diseases of the skin and subcutaneous tissue	27,182	22.0 (21.5–22.4)	65,837	24.9 (24.6–25.2)	<0.001
Diseases of the musculoskeletal system	37,871	30.6 (30.1–31.1)	80,993	30.6 (30.3–30.9)	0.936
Region of hospital					
Northeast	15,654	12.7 (12.7–12.7)	60,565	22.9 (22.9–22.9)	<0.001
Midwest	21,961	17.7 (17.7–17.7)	52,841	20.0 (20.0–20.0)	
South	49,771	40.2 (40.2–40.2)	99,186	37.5 (37.5–37.5)	
West	36,344	29.4 (29.4–29.4)	52,229	19.7 (19.7–19.7)	
Disposition of patient from emergency department					
Transfer to short-term hospital	1,584	1.3 (1.2–1.4)	831	0.3 (0.3–0.4)	<0.001
Other transfers (including skilled nursing facility, intermediate care, and another type of facility)	275	0.2 (0.2–0.3)	359	0.1 (0.1–0.2)	
Admitted as an inpatient to this hospital	121,153	97.9 (97.8–98.1)	262,218	99.0 (98.9–99.1)	
Died in emergency department	718	0.6 (0.5–0.7)	1,413	0.5 (0.5–0.6)	
Disposition of patient from hospital					
Discharged home or home health care	36,604	30.2 (29.8–30.7)	75,653	28.9 (28.5–29.2)	<0.001
Transfer to short-term hospital or other transfers (including skilled nursing facility, intermediate care, and another type of facility)	49,238	40.7 (40.2–41.2)	100,236	38.2 (37.9–38.6)	
Deceased	34,014	28.1 (27.6–28.6)	84,457	32.2 (31.9–32.5)	
Against medical advice or discharged alive with unknown destination	1,222	1.0 (0.9–1.1)	1,824	0.7 (0.6–0.8)	
In-hospital mortality					
No	88,999	71.9 (71.5–72.4)	178,950	67.6 (67.2–67.9)	<0.001
Yes	34,731	28.1 (27.6–28.5)	85,871	32.4 (32.1–32.8)	
Average length of stay, d	121,135	10.20 (10.09–10.31)	262,177	12.47 (12.37–12.58)	<0.001
Hospital procedures (for patients admitted to the same hospital of the emergency department)	n=121,154		n=262,218		
Small bowel resection	479	0.4 (0.3–0.5)	675	0.3 (0.2–0.3)	<0.001
Colorectal resection	2,615	2.2 (2.0–2.3)	5,264	2.0 (1.9–2.1)	0.104
Appendectomy	756	0.6 (0.5–0.7)	1,173	0.4 (0.4–0.5)	<0.001
Fluoroscopy of the biliary and pancreatic ducts (ERCP, ERC and ERP)	478	0.4 (0.3–0.5)	1,161	0.4 (0.4–0.5)	0.260
Cholecystectomy and common duct exploration	1,561	1.3 (1.2–1.4)	2,376	0.9 (0.8–1.0)	<0.001
Laparoscopy (GI only)	493	0.4 (0.3–0.5)	1,045	0.4 (0.4–0.4)	0.834
Exploratory laparotomy	383	0.3 (0.3–0.4)	1,276	0.5 (0.4–0.5)	<0.001
Other non-operative upper GI therapeutic procedures	3,324	2.7 (2.6–2.9)	9,163	3.5 (3.4–3.6)	<0.001
Other operative upper GI therapeutic procedures	1,647	1.4 (1.2–1.5)	4,297	1.6 (1.6–1.7)	0.001
Other non-operative lower GI therapeutic procedures	690	0.6 (0.5–0.7)	1,832	0.7 (0.6–0.8)	0.013
Other operative lower GI therapeutic procedures	2,812	2.3 (2.2–2.5)	6,823	2.6 (2.5–2.7)	0.006
Other gastrointestinal diagnostic procedures	1,913	1.6 (1.5–1.7)	6,807	2.6 (2.5–2.7)	<0.001
Other non-operative gastrointestinal therapeutic procedures	3,207	2.6 (2.5–2.8)	8,636	3.3 (3.2–3.4)	<0.001
Other operative gastrointestinal therapeutic procedures	2,643	2.2 (2.0–2.3)	6,750	2.6 (2.5–2.7)	<0.001
Respiratory intubation and mechanical ventilation	56,761	46.9 (46.3–47.4)	132,550	50.5 (50.2–50.9)	<0.001

ERCP: endoscopic retrograde cholangiopancreatography; ERC: endoscopic retrograde cholangiography; ERP: endoscopic retrograde pancreatography; GI: gastrointestinal.

Table 4. Crude and adjusted odds ratio of mortality in septic shock patients

Teaching status of hospital	Crude			Adjusted*		
	OR	95% CI	P-value	OR	95% CI	P-value
Metropolitan non-teaching	-	-	-	-	-	-
Metropolitan teaching	1.230	1.196–1.264	<0.001	1.295	1.256–1.335	<0.001

*Adjusted for: hospital teaching status; age; indicator of sex; infectious and parasitic disease; neoplasms; endocrine, nutritional, and metabolic diseases and immunity disorders; diseases of blood and blood-forming organs; diseases of the circulatory system; diseases of the respiratory system; diseases of the digestive system; diseases of the skin and subcutaneous tissue; region of hospital; average length of stay; hospital procedures (small bowel resection; colorectal resection; appendectomy; fluoroscopy of the biliary and pancreatic ducts; cholecystectomy and common duct exploration; laparoscopy [GI only]; Exploratory laparotomy; other non-operative upper GI therapeutic procedures; other operative upper GI therapeutic procedures; other non-operative lower GI therapeutic procedures; other operative lower GI therapeutic procedures; other gastrointestinal diagnostic procedures; other non-operative gastrointestinal therapeutic procedures; other operative gastrointestinal therapeutic procedures; respiratory intubation and mechanical ventilation); GI: gastrointestinal.

the United States. In addition, there can be variability in coding from one ED to another which might affect the selection of septic shock patients by not including all eligible patients. However, the ICD-10 CM for septic shock was used to obtain the data from the NEDS database to catch as many patients as possible. In the NEDS database, each admission from the ED to the hospital leads to the generation of one discharge record. A transfer from one ED to another would result in two discharge records: one from the initial hospital and one from the receiving hospital. If both hospitals participate in the database, both records will be included. Transfer from one ED to another ED occurred in only 1.5% of the NEDS records.^[18] The low percentage of patients who fit the previous category would less likely skew the results. Furthermore, several variables, such as APACHE scores, SOFA scores, vital signs, lab parameters and therapeutic measures (intravenous fluid requirements and vasopressor requirements) were not included in the database and play a role in mortality comparison. Finally, it is important to note that information regarding hospital performance metrics, resident training level at teaching hospitals or the level of expertise of physicians at non-teaching hospitals was not available, which might have influenced the outcomes of the study.

CONCLUSION

Septic shock patients presenting to a metropolitan teaching hospital had significantly higher odds of mortality than those presenting to metropolitan non-teaching hospitals. Patients presenting to teaching hospitals had higher rates of pre-existing medical conditions. They also had higher rates of intubation and mechanical ventilation and longer lengths of hospital stay. These findings are interesting given the changing nature of sepsis management. Further studies are needed to study the association between hospital teaching status

and mortality in septic shock patients.

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