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Trauma ICU Prevalence Project: the diversity of surgical critical care

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ABSTRACT

Background Surgical critical care is crucial to the care of trauma and surgical patients. This study was designed to provide a contemporary assessment of patient types, injuries, and conditions in intensive care units (ICU) caring for trauma patients.

Methods This was a multicenter prevalence study of the American Association for the Surgery of Trauma; data were collected on all patients present in participating centers' trauma ICU (TICU) on November 2, 2017 and April 10, 2018.

Results Forty-nine centers submitted data on 1416 patients. Median age was 58 years (IQR 41–70). Patient types included trauma (n=665, 46.9%), non-trauma surgical (n=536, 37.8%), medical (n=204, 14.4% overall), or unspecified (n=11). Surgical intensivists managed 73.1% of patients. Of ICU-specific diagnoses, 57% were pulmonary related. Multiple high-intensity diagnoses were represented (septic shock, 10.2%; multiple organ failure, 5.58%; adult respiratory distress syndrome, 4.38%). Hemorrhagic shock was seen in 11.6% of trauma patients and 6.55% of all patients. The most common traumatic injuries were rib fractures (41.6%), brain (38.8%), hemothorax/pneumothorax (30.8%), and facial fractures (23.7%). Forty-four percent were on mechanical ventilation, and 17.6% had a tracheostomy. One-third (33%) had an infection, and over half (54.3%) were on antibiotics. Operations were performed in 70.2%, with 23.7% having abdominal surgery. At 30 days, 5.4% were still in the ICU. Median ICU length of stay was 9 days (IQR 4–20). 30-day mortality was 11.2%.

Conclusions Patient acuity in TICUs in the USA is very high, as is the breadth of pathology and the interventions provided. Non-trauma patients constitute a significant proportion of TICU care. Further assessment of the global predictors of outcome is needed to inform the education, research, clinical practice, and staffing of surgical critical care providers.

Level of evidence IV, prospective observational study.

BACKGROUND

Trauma centers in the USA often have a designated trauma intensive care unit (TICU) where the most critically ill and injured patients can receive high-level care. The American College of Surgeons Committee on Trauma requires that verified trauma centers have a designated ICU for trauma patients, and that a surgeon be the director or codirector of that ICU.[1] Trauma surgeons are often board certified in surgical critical care (SCC), enabling them to provide care for their own patients in the TICU. This is advantageous because severely injured patients have better outcomes when provided with continuity of management within the same surgical service.[2–5]

With the advent of the acute care surgery (ACS) model over the last 15 years,[6] many trauma surgeons provide both the operative management and perioperative critical care for complex emergency general surgery patients, as well as ICU management of other subspecialty surgical patients. So far, surgeons have met the challenge with an expansion of the SCC workforce. Fellows in SCC constituted only 7.6% of all critical care trainees in 2009[7]; from 2007 through 2016, SCC represented 17% (1569 of 9225) of all critical care board certificate recipients.[8] Although the specialty of SCC has been previously outlined,[9] an updated description of the types of patients cared for by SCC specialists in designated TICUs is needed from time to time to ensure that education and resources match the current needs of critically ill patients.

In the Trauma ICU Prevalence Project (TRIPP) study, we seek to provide a contemporary description of the variety of patients in TICUs at major trauma centers, as well as their injuries, pathologies, diagnoses, and short-term outcomes. Such information may be useful as a needs assessment in several areas, as had been done with the initial development of trauma systems as well as the more recent ACS paradigm, which were each driven by identified needs of trauma and emergency general surgery patients, respectively.[10] Likewise, updating our understanding of SCC and TICU patients may serve to inform training and educational curricula for SCC programs, identify priorities for outcome-based research, and guide hospitals in allocating resources and staffing to suit the needs of their patient population. This prevalence study of TICUs at trauma centers across the USA was done to help provide a snapshot of current critical care needs of patients in TICUs.

METHODS

This was a multicenter point prevalence study performed on 2 data collection days: November 2, 2017 and April 10, 2018 (study days 1 and 2, respectively). The coordinating center was Inova Fairfax Hospital. The study was approved as a Multi-Institutional Trial (MIT) of the American Association for the Surgery of Trauma (AAST). Primary Institutional Review Board (IRB) approval was obtained at the coordinating center, and then from each participating hospital prior to their data submission. Participant centers were recruited on a voluntary basis. All level 1 and 2 trauma centers were eligible to participate; those responding to the study's listing on the AAST MIT website, social media, email, and personal communication were included. After submitting an application with the AAST and approval by the primary investigator (PI) and their local IRB, centers were then enrolled and received password access to the data collection tool. Enrollment was continued after study day 1; centers may have participated on both study days or only on study day 2. Results pertaining only to study day 2 are documented as such. ICU patient populations were described as trauma (≥80% trauma patients), surgical/trauma (<80% trauma patients), or medical/surgical (routinely containing surgical and non-surgical patients).

Participant centers were asked to prospectively collect data in the single ICU where the majority of their trauma patients received care; this ICU was designated as the 'TICU' for our study. Centers collected patient-level data on each study day and 30-day follow-up information on study patients including length of stay (LOS) and mortality. All patient data that were collected pertained to the specific study days and reflected conditions present on those days. Data from both study days were pooled for the current analysis, unless stated otherwise. Upper threshold limits were placed on reportable age (maximum 89 years) for reasons of patient privacy and on hospital, ICU, and ventilator days (maximum 199 each) to facilitate data analysis.

Data were selected from prespecified lists of categories and options that were created by the authors. A data dictionary was not used, and specific criteria for diagnoses and conditions were not prespecified. Instead participants were asked to provide diagnoses as documented in the medical record, based on their clinical practice. We did not verify that patients' diagnoses matched established criteria for those diagnoses. This methodology was used to promote ease of participation and facilitate data collection by avoiding detailed chart reviews or extensive cross-referencing, since we requested all data collection to be done prospectively on the study days. For example, patients having acute respiratory distress syndrome (ARDS) were reported as such at the discretion of the data collector, and not classified by the authors based on prespecified ARDS criteria such as PaO_2:FIO_2 ratio. Likewise, ventilator-associated pneumonia (VAP) was defined at the participants' discretion and not based on Centers for Disease Control and Prevention criteria.

Infections were included if they were being actively treated with antimicrobial agents on the study day, or if surgical treatment was required during the index hospital stay. 'ICU diagnoses' were defined as those present at some time during the ICU stay; these may have developed either during the ICU stay, or earlier during the hospital stay and carried over to the ICU admission. Diagnoses were included if present at some point during the ICU stay and did not have to be 'active' on the study day.

Patients were classified based on their primary reason for ICU admission as 'trauma' for traumatic injury, 'non-trauma surgical' for those being managed for an operative or non-operative surgical condition, or 'medical' for all others. Non-trauma surgical patients were further classified based on the type of surgical condition for which they were admitted to the ICU (eg, vascular, general surgery, and so on). All data were deidentified and entered directly by each individual center into the AAST data collection tool website where they were assigned unique identification codes; only the overall study PI had access to this password-protected database.

Frequencies and percentages are reported for categorical variables. Medians with IQRs or means with SDs are reported for continuous variables as appropriate. Pearson's χ^2 test was used to compare the categorical variables, Fisher's exact test when any cell size was less than or equal to 5. Student's t-test was used to compare continuous variables when normality assumption was met; otherwise the Mann-Whitney-Wilcoxon rank-sum test was applied instead. All tests were two sided. P values of less than 0.05 were considered statistically significant. All analysis was performed in R (R Development Core Team).

Table 1 Hospital and ICU characteristics

Variables	Levels	n/Median	%/IQR
Hospital size	<250 beds	2	4.08%
	250–499 beds	16	32.65%
	500–749 beds	18	36.73%
	750–999 beds	7	14.29%
	≥1000 beds	6	12.24%
State trauma center designation	Level 1	45	91.84%
	Level 2	4	8.16%
American College of Surgeons verified	No	10	20.41%
	Yes	39	79.59%
Urban		48	97.95%
Rural		1	2.04%
University		29	59.1%
Non-university		20	40.8%
Geographic location	Northeast	10	20.4%
	Southeast	9	18.3%
	Midwest	8	16.3%
	Southwest	9	18.3%
	West	13	26.5%
Adult ICU beds, n		70	(53–102)
Pediatric ICU beds, n		30	(0–73)
Total ICU beds, n		105	(64–181)
Number of trauma patients evaluated as a formal 'trauma activation' per year	<1000	5	10.20%
	1000–1999	15	30.61%
	2000–2999	13	26.53%
	3000–3999	5	10.20%
	≥4000	11	22.45%

ICU, intensive care unit.

RESULTS

Forty-nine level I and II trauma centers (table 1) submitted data on 1416 patients, of whom 518 (36.5%) were female, with 11 having sex not reported. Patients had a median age of 58 years (IQR 41–70, range 14–90). Participating ICUs included 19 (38.7%) identified as trauma, 23 (46.9%) surgical/trauma, and 7 (14.2%) medical/surgical.

As of the study day, patients had spent a median of 5 days (IQR 2–13) in the hospital and 4 days (IQR 2–10, range 1–199) in the ICU. At 30-day follow-up, 71 patients (5.4%) were still in the ICU. For all patients, the total median hospital LOS was 16 days (IQR 8–30, range 1–199) and ICU LOS was 9 days (IQR 4–20, range 1–199). Of those with data available at 30-day follow-up (n=1301), 146 (11.2%) had died, and 1084 (83.3%) were discharged alive.

Table 2 Injury categories for trauma patients (n=665)

Injuries	n	%
Rib fractures	277	41.65
Brain	258	38.80
Pneumothorax or hemothorax	205	30.83
Facial fracture	158	23.76
Cervical spine fracture	139	20.90
Lung contusion	139	20.90
Lower extremity long bone fracture	122	18.35
Thoracic spine fracture	108	16.24
Lumbar spine fracture	89	13.38
Upper extremity long bone fracture	89	13.38
Major vascular	88	13.23
Liver	83	12.48
Pelvic fracture—operative	62	9.32
Spleen	58	8.72
Spinal cord injury with neurological deficit	55	8.27
Stomach or small bowel	55	8.27
Pelvic fracture—non-operative	54	8.12
Kidney	45	6.77
Colon or rectum	38	5.71
Pancreas	18	2.71

Categories are not mutually exclusive.

Trauma patients constituted 46.9% of ICU patients (n=665), whereas 740 (52.2%) were non-trauma patients. Of the non-trauma patients, 536 (72.2%; 37.8% overall) were non-trauma surgical, 204 (27.5%; 14.4% overall) were medical, and 11 (0.7%) were not specified. On study day two, 73.1% of patients (669 of 915) were managed by a surgical intensivist (vs. non-surgical or no intensivist), 11 (1.2%) were receiving comfort care measures only, and 4 (0.4%) were deceased organ donors.

For trauma patients, the prevalence of major injuries is listed in table 2. This includes injuries that were already treated, for example, a pneumothorax treated earlier with a tube thoracostomy that had already been removed. Rib fractures and brain injuries were the most common injury types. Head, neck, and thoracic injuries constituted the top six injury categories. On study day 2, hemorrhagic shock was present in 49 of 421 (11.6%) trauma patients.

Table 3 Classification of non-trauma surgical patients (n=536)

Category	n	%
Abdominal	184	34.33
Neurological condition	100	18.66
Other general surgery	80	14.93
Vascular	60	11.19
Cardiac	33	6.16
Plastics or oral-maxillofacial surgery	18	3.36
Transplant	18	3.36
Orthopedic	15	2.80
Thoracic	15	2.80
Burns or inhalation injury	7	1.31
Obstetrics, gynecology, gyn-oncology	6	1.12

Categories are mutually exclusive.

Table 4 Primary ICU admission diagnosis categories for non-trauma surgical patients (n=536)

ICU admission diagnosis	n	%
Respiratory	195	36.38
Cardiovascular	139	25.93
Infectious	128	23.88
Gastrointestinal	127	23.69
Neurological	106	19.78
Monitoring	89	16.60
Renal	63	11.75
Metabolic	50	9.33
Hematological	41	7.65
Psychiatric	3	0.56

Categories are not mutually exclusive.
ICU, intensive care unit.

General classification categories for non-trauma surgical patients are listed in table 3. Abdominal conditions predominated, existing in just over one-third of patients, with neurological conditions being the second most common. ICU admission diagnoses for non-trauma surgical patients are listed in table 4 and reflect the primary disease process or organ system requiring ICU admission, not conditions starting after admission. Respiratory conditions were the most common admission diagnoses.

ICU diagnoses for all 1416 patients are reported in table 5. Among the 1416 patients, 807 (57%) had a pulmonary-related diagnosis (respiratory failure, pneumonia, ARDS, or pulmonary embolism), with 552 (39%) having only one pulmonary-related diagnosis and 207 (14.6%) having two.

Operative procedures were performed on 70.2% of 1416 patients during or prior to their ICU admission (table 6). Abdominal surgery was the most common procedure, having been performed in almost one-quarter of all patients. Surgery was performed in 69.1% (460 of 665) of trauma patients and 72.2% (535 of 740) of non-trauma patients.

Pre-existing comorbidities were present in 77.5% of patients. Conditions that were seen in over 10% of patients included hypertension (38.5%), diabetes (23.7%), obesity (body mass index >30 kg/m^2; 15.8%), tobacco use (14.3%), chronic alcohol use (12.6%), ischemic heart disease (12.5%), arrhythmia (12.3%), and chronic obstructive pulmonary disease (11.2%).

At least one type of infection was present in 468 patients (33%), and 68 patients (4.8%) had two or more infections. The range of infections included VAP (n=155, 11% of all patients, 25% of those on a ventilator), intra-abdominal infection (n=143, 10.1%), necrotizing soft tissue infection (n=84, 5.9%), other hospital-acquired pneumonia (n=71, 5%), catheter-associated urinary tract infection (CAUTI; n=56, 4%), central line-associated bloodstream infection (n=29, 2.1%), and Clostridium difficile colitis (n=24, 1.7%). Over half of patients (n=770, 54.3%) were receiving antibiotics on the study day, and 137 (9.7%) were receiving antifungal agents.

Acuity of illness was high, with 623 (44%) being intubated and on mechanical ventilation and 249 (17.6%) having a tracheostomy. By 30 days after the study day, patients had a median of 3 (IQR 0–13, range 0–199) ventilator days. The median number of ventilator days prior to tracheostomy was 9 (IQR 5–13, range 0–50). A central venous catheter was present in 523 (36.9%), 188 (13.3%) had a peripherally inserted central catheter, 163 (11.5%) had a non-invasive cardiac output monitor, and 20 (1.1%) had a pulmonary artery catheter. One hundred and eighty-five patients

Table 5 ICU diagnoses for all patients (n=1416)

Diagnosis	n	%
Respiratory failure, tracheally intubated	668	47.18
Acute anemia	348	24.58
None	328	23.16
Delirium	221	15.61
Acute kidney injury (without filtration or dialysis)	204	14.41
Sepsis	191	13.49
Coma (Glasgow Coma Scale score <9)	169	11.94
Arrhythmia requiring treatment	107*	11.69
Pneumonia, ventilator associated (VAP)	159	11.23
Septic shock	145	10.24
Respiratory failure, not intubated	96	6.78
Acute kidney injury requiring hemofiltration or dialysis	96	6.78
Skin soft tissue infection	94	6.64
Hemorrhagic shock	60*	6.55
Pneumonia, not ventilator associated (non-VAP)	91	6.43
Intra-abdominal infection	52*	5.68
Multiple organ failure	79	5.58
Pressure ulceration, decubitus, or deep tissue injury	67	4.73
Adult respiratory distress syndrome	62	4.38
Other bleeding	39*	4.26
Myocardial ischemia or infarction	60	4.24
Stroke	57	4.03
Urinary tract infection—catheter associated (CAUTI)	56	3.95
Deep vein thrombosis	53	3.74
Physical agitation requiring in-room supervision	50	3.53
Urinary tract infection (not CAUTI)	38	2.68
Pulmonary embolism	38	2.68
Upper gastrointestinal hemorrhage	34	2.40
Hypoxic/anoxic brain injury	17*	1.85
Adrenal insufficiency treated with steroids	15*	1.63
Central line-associated bloodstream infection	23	1.62
Clostridium difficile colitis	21	1.48
Lower gastrointestinal hemorrhage	14	0.99
ECMO used during this ICU stay	7	0.49

Categories are not mutually exclusive.
*Prevalence calculated using only study day 2 patients, n=915.
ECMO, extracorporeal membrane oxygenation; ICU, intensive care unit.

Table 6 Operations performed during the hospital stay on ICU patients

	All (n=1416)*	Trauma (n=665)	Non-trauma (n=740)
Operations	n (%)	n (% trauma/% all)	n (% non-trauma/% all)
Any	995 (70.2)	460 (69.1/32.4)	535 (72.2/37.7)
None	421 (29.7)	205 (30.8/14.4)	216 (29.1/15.2)
Abdominal surgery	336 (23.7)	127 (19.0/8.9)	209 (28.2/14.7)
Other	215 (15.2)	94 (14.1/6.6)	121 (16.3/8.5)
Extremity bone, orthopedics	168 (11.9)	151 (22.7/10.6)	17 (2.2/1.2)
Soft tissue: injury, infection, fasciotomy	126 (8.9)	41 (6.1/2.8)	85 (11.4/6.0)
Spine	112 (7.9)	91 (13.6/6.4)	21 (2.8/1.4)
Craniotomy or craniectomy	97 (6.9)	64 (9.6/4.5)	33 (4.4/2.3)
Endovascular, including embolization	66 (4.7)	41 (6.1/2.8)	25 (3.3/1.7)
Vascular surgery: peripheral, extremities, neck	64 (4.5)	16 (2.4/1.1)	48 (6.4/3.3)
Thoracic surgery (non-cardiac, non-vascular)	62 (4.4)	42 (6.3/2.9)	20 (2.7/1.4)
Pelvic bone, orthopedics	59 (4.2)	56 (8.4/3.9)	3 (0.4/0.2)
Vascular surgery: aorta, central thoracic vessel	43 (3.0)	15 (2.2/1.0)	28 (3.7/1.9)
Facial bones	35 (2.5)	32 (4.8/2.2)	3 (0.4/0.2)
Cardiac	34 (2.4)	8 (1.2/0.5)	26 (3.5/1.8)

Categories are not mutually exclusive.

*Includes 11 patients not categorized as trauma or non-trauma.
ICU, intensive care unit.

(13%) were on a vasopressor infusion. One hundred and eighty-eight (13.2%) were comatose and 543 (38.4%) had an altered mental status. Intracranial pressure monitors were present in 96 (6.7%), with external ventricular drains (n=62) being almost twice as prevalent as intraparenchymal monitors. Within the prior 24 hours, 222 patients (15.7%) received a red blood cell transfusion and 75 (5.3%) received plasma.

DISCUSSION

The TRIPP study is a 2-day examination of the prevalence of injuries, diagnoses, and treatments in a group of ICUs designated to care for trauma patients. The findings reveal a picture of high medical acuity and a wide breadth of pathology. Surgical interventions and invasive monitoring were common in this population. Mechanical ventilation was being used in almost half (44%) of patients, 17.6% had a tracheostomy, 13.2% were comatose, almost 1 in 6 was transfused with red cells within the previous 24 hours, and 1 out of every 8 was on a vasoactive infusion. Over half (54.3%) of patients were on antibiotics. TICU patients had a median ICU stay of 9 days, and a 30-day mortality of 11.2%. Notably, 5.4% were still in the ICU at 30 days from the study day.

Despite this high acuity, 'monitoring' was selected as the reason for ICU admission for 16.6% of non-trauma surgical patients, and 23% of all patients had none of the 32 common ICU diagnoses that were listed as choices. Due to the intentional lack of specificity for our data collection, we cannot determine whether or not these conditions represented real overtriage. Although ICU admission, discharge, and triage guidelines are available,[11] they are not often used in real time.[10] Recent Society of Critical Care Medicine guidelines suggest that overtriage is more acceptable than undertriage.[11] Though a certain degree of overtriage provides a potential safeguard against complications or delays in care, unwarranted overtriage may adversely impact bed utilization, as well as physician/hospital billing and reimbursement since ICU beds, staff, work time, and other resources are being used for patients without a verified critical care diagnosis.

Prevalence data such as these may be helpful in determining clinical benchmarks. Defining benchmarks is important in critical care, but few are available specifically for TICUs. In 2011, a large study using the eICU Research Institute database sought to report benchmarks by reviewing data from 271 ICUs.[12] Only 861 of the over 243,000 patients were in a TICU. The acuity in that study was lower than in TRIPP, probably because the eICU was not used in TICUs at major trauma centers with high-intensity

ICU staffing. That study showed a 5.5% trauma mortality rate, with 18.4% of patients being on mechanical ventilation, and 5.8% on vasopressors, each of which was less than half of the rates in our study. Nevertheless, this demonstrates the importance of determining specialty-specific benchmarks, so that accurate comparisons can be made between hospitals and caregivers can set realistic goals for their patient population.

One area where our data can contribute to establishing benchmarks is hospital-acquired infections (HAI). Rates of HAI are notoriously variable depending on the methodology used for diagnosis and reporting, as seen with VAP in trauma patients.[13 14] Likewise, CAUTI rates are highly influenced by the propensity of providers to culture urine based on general symptoms (eg, fever) rather than selectively.[15] Our study did not specify diagnostic methods for the reported infections, and the HAI rates reported should not be viewed as 'ideal' rates, but they may provide insight into current trends at major trauma centers. The high prevalence of VAP in our study indicates that this condition still warrants the attention of ICU providers, and that despite years of focused prevention efforts, this infection is still common in these high-risk patients. Intra-abdominal infections were seen in 10.1% of TICU patients. In contrast, a large international prevalence study[16] reported abdominal infections in 19.6% of ICU patients, though only 3.4% of those infected were trauma patients, and a separate rate for patients in US ICUs was not provided.

The assessment of prevalence for certain conditions in this study may be tempered by our use of a purely practical approach to categorizing diagnoses. That is, if the clinicians documented a diagnosis on a study patient, there followed a presumption that the diagnosis was made in accordance with current medical standards. Whereas certain diagnoses such as ARDS and VAP have well-defined criteria, the vast majority of diagnoses in our study do not, or have criteria that are so widely inclusive that false positives are expected to be unlikely (eg, gastrointestinal bleeding, intra-abdominal infection). Our intention was to provide a general overview of the TICU population rather than a highly specific one.

A wide range of traumatic injuries was seen in the 665 trauma patients. Head, neck, and thoracic injuries predominated, but spine, orthopedic, vascular, and intra-abdominal injuries were also prevalent. The incidence of certain traumatic injuries has been widely reported elsewhere in the literature. Our findings, however, specifically reflect injury patterns that intensivists can expect to find in a TICU. Over 69% of the trauma patients had a major operation, illustrating the ongoing surgical nature of trauma and the importance of surgical subspecialty care at trauma centers.

Respiratory conditions were common, which is not unexpected in a critical care unit. Respiratory diagnoses were the most common ICU admission diagnoses for non-trauma surgical patients (36%), and over half of all study patients (57%) had a pulmonary-related diagnosis. High-intensity diagnoses such as septic shock, hemorrhagic shock, multiple organ failure, and ARDS were not highly prevalent individually, but the spectrum of diagnoses being managed in all 1416 patients was broad. The significant proportion of patients having a tracheostomy (17.6%) also indicates the severity of illness in TICU patients. Interestingly, the timing of tracheostomy tended toward later, with a median of 9 ventilator days prior to the procedure.

A notable finding in this study of TICUs is that although trauma was the most common type of patient classification (46.9%), there were more non-trauma patients present in these TICUs on the study days. Of the non-trauma surgical patients, about half had an abdominal or other general surgical condition, and abdominal surgery was the most common category of operation for all non-trauma patients. Yet we found wide representation of the spectrum of surgical diseases, both in general disease categories and in the types of operations performed on these patients. These findings illustrate the diversity of patient types in TICUs, and the diversity of critical care provider expertise necessary to care for them. This fact has obvious implications for surgical training, ongoing education for physicians and nurses, and resource allocation for hospitals.

On study day two, 73.1% of patients were managed by a surgical intensivist. For the specialty of SCC to thrive, it needs to evolve to meet the demands of patients. This study describes a patient population in TICUs that is very diverse and that goes beyond traditional trauma pathology, encompassing a large number of non-trauma surgical and even medical patients. Furthermore, the population was profoundly comorbid, with pre-existing conditions seen in 77.5% and a median age of 55.2 years. This high median age reflects national age trends for injured patients, in whom falling has become the dominant injury mechanism. Geriatric care has become routine at most trauma centers and our data show that the TICU population has a wide age range and a significant number of older adults.

SCC providers and SCC fellowship programs must be prepared to manage the extensive breadth of conditions seen in TICUs as well as ICUs that are not trauma focused, including non-surgical conditions and comorbidities that affect surgical patients. Fellowship curricula provided by the ACGME[17] and the Surgical Critical Care Program Directors Society[18] are expansive. However, SCC fellowships are universally linked with major trauma programs, and the development of ACS fellowships starting in 2008 has focused almost exclusively on expanding the surgical management and operative skills of trainees. This study illuminates the need to ensure that SCC training continues to be inclusive of non-trauma and also non-surgical conditions, for the purpose of maintaining a versatile and capable SCC workforce and sustaining the representation of surgical specialists in the world of critical care medicine. The specialty of SCC and management of patients in TICUs are geared toward the unique needs of surgical patients, and in some studies this narrow focus has demonstrated benefit in terms of lower ventilator days,[3] complications,[2–4] and mortality.[4 5] This is consistent with evidence showing a survival benefit for patients treated in an ICU matched to their specific needs rather than boarding in another specialty unit.[19] Although SCC training by its nature leans heavily on trauma and common surgical conditions, programs should also consider the breadth of disease and clinical demographics of contemporary TICUs so that future SCC specialists are also prepared to treat non-surgical conditions that are frequently present in their patients.

Limitations of this study should be noted. Particularly, the 49 centers voluntarily participating in this study may not be representative of trauma centers or TICUs on a national scale, and judgment should be exercised when interpreting these data with reference to individual TICUs. Categories of conditions and diagnoses were not exhaustive, and were often collected by participants from a list of predetermined options. Therefore, many ICU conditions may be under-represented or missing in our data set. Because categories and options for classification were intentionally kept general, a degree of subjectivity was introduced such that participants used their best judgment in choosing which diagnoses and categories fit their patients. As a result, we cannot verify that certain diagnoses reported here were made in accordance with established diagnostic criteria for those conditions. This methodology was purposeful, because requiring compliance with a data dictionary for the extensive list of diagnoses in this study would have been labor intensive and possibly prohibitive to enrollment for those centers without robust research resources and personnel. Finally, in the current study, we have not attempted to analyze our findings with respect to patient outcomes. Future studies are planned in which such analyses will be undertaken.

In summary, this large multicenter prevalence study at major trauma centers provides an overview of the types of patients, interventions, and pathology commonly seen in TICUs. These findings have implications for the education, research, clinical practice, and staffing of SCC providers. Further investigation is needed to assess the association of these findings with outcomes at the ICU and patient level.

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