Original Investigation

Evaluation of the Perceived Association Between Resident Turnover and the Outcomes of Patients Who Undergo Emergency General Surgery
Questioning the July Phenomenon

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IMPORTANCE The influx of new surgical residents and interns at the beginning of the academic year is assumed to be associated with poor outcomes. Referred to as *the July phenomenon*, this occurrence has been anecdotally associated with increases in the frequency of medical errors due to intern inexperience. Studies in various surgical specialties provide conflicting results.

OBJECTIVE To determine whether an association between the July phenomenon and outcomes exists among a nationally representative sample of patients who underwent emergency general surgery (EGS).

DESIGN, SETTING, AND PARTICIPANTS Retrospective analysis of data from the 2007-2011 Nationwide Inpatient Sample. Data on adult patients (≥16 years of age) presenting to teaching hospitals with a principal diagnosis of an EGS condition, as defined by the American Association for the Surgery of Trauma, were retrospectively analyzed. The patients who were included in our study were dichotomized into early (July-August) vs late (September-June) management. The original analyses were conducted in March 2015.

MAIN OUTCOMES AND MEASURES Risk-adjusted multivariable regression based on calculated propensity scores was assessed for associations with differences in in-hospital mortality, complications, length of stay, and total hospital cost.

RESULTS A total of 1 433 528 patients who underwent EGS were included, weighted to represent 7 095 045 patients from 581 teaching hospitals nationwide; 17.6% were managed early. Relative to patients managed later, early patients had marginally lower risk-adjusted odds of mortality (odds ratio [OR], 0.96 [95% CI, 0.92-0.99]), complications (OR, 0.98 [95% CI, 0.96-0.99]), and developing a secondary EGS condition (OR, 0.97 [95% CI, 0.97-0.98]). Length of stay and total hospital cost were comparable between the 2 groups ($P > .05$).

CONCLUSIONS AND RELEVANCE Contrary to expectations, the EGS patients who were managed early fared equally well, if not better, than the EGS patients who were managed later. Potentially attributable to increased manpower and/or hypervigilance on the part of supervising senior residents or attending physicians, the results suggest that concerns among EGS patients related to the July phenomenon are unfounded.

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Invited Commentary page 224

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Trends in morbidity and mortality associated with surgical procedures are understood to demonstrate seasonal variation, with spikes anticipated during the mid to late summer months (July and August).[1-5] At teaching hospitals, the time corresponds to major changes in surgical personnel as medical school graduates begin their time as interns or junior residents on surgical services across the country. Some surgeons believe that this annual influx of new surgical residents is associated with poor patient outcomes.[4] Referred to as *the July phenomenon*, this occurrence has been anecdotally associated with increases in the frequency of medical errors due to intern inexperience.[4]

Data from various surgical specialties provide conflicting results. Work among patients with femoral neck fractures,[1] children undergoing shunt surgery,[2] and patients presenting for trauma[3] have demonstrated increases in adverse outcomes associated with the beginning of the academic year. Other studies conducted among cardiac patients,[4] patients admitted to the intensive care unit,[5] patients with appendicitis,[6] patients undergoing obstetric procedures,[7] and patients undergoing complex neurosurgical procedures[8] revealed a lack of significant results, as well as contrasting results.

At teaching hospitals, emergency general surgery (EGS) forms the majority of acute care services' case and patient loads.[9-12] To meet the demands of these high-volume services, junior and senior residents, in addition to attending physicians, are often called on to provide care and make patient-management decisions. The heightened involvement of surgical trainees in EGS conditions provides an ideal population within which to help clarify the role of the July phenomenon. A majority of prior studies in other populations have been limited by their inability to restrict their analysis to teaching hospitals, where interns and residents form an essential part of the workforce. Based on these considerations, the objective of our study was to determine whether an association between the July phenomenon and outcomes exists among a nationally representative population of EGS patients presenting to teaching hospitals in the United States.

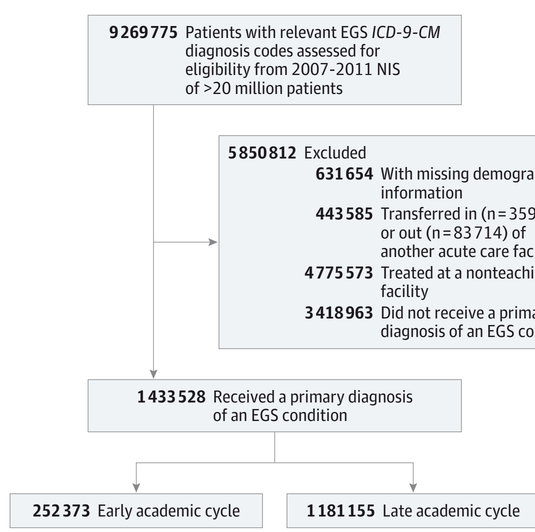
Methods

The Nationwide Inpatient Sample (NIS) is the largest publically available all-payer database of US hospital billing data. Sponsored by the Agency for Healthcare Research and Quality under the Healthcare Cost and Utilization Project, the NIS represents a 20% stratified sample of hospitals selected based on geographic region, ownership control, urban/rural location, teaching status, and number of hospital beds. The sampling frame consists of 90% of all hospital discharges. The NIS-provided design weights allow for the calculation of national estimates considered representative of 95% of the US patient population. Available data elements include information on age, sex, race/ethnicity, primary payer, length of stay (LOS), total charges, disposition, hospital characteristics, and up to 15 *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*)–based procedure and diagnosis codes.

Data from the 2007-2011 NIS on all adult patients (≥16 years of age) presenting to a teaching hospital with a primary *ICD-9-CM* diagnosis code for an EGS condition, as defined by the American Association for the Surgery of Trauma, were retrospectively analyzed.[13] Predefined hospital teaching status was based on the American Hospital Association's Annual Survey of Hospitals.[14] To be considered a teaching hospital, an institution is required to have an American Medical Association–approved residency program, be a member of the Council of Teaching Hospitals, or have a ratio of full-time equivalent interns or residents to beds of 0.25 or higher. Inclusion and exclusion criteria are presented schematically in **Figure 1**. Patients with an EGS condition were also evaluated for the development of a secondary (diagnosis codes 2-15) EGS condition, assumed to have occurred during the hospital stay, following an unrelated primary diagnosis. Patients who did not develop secondary conditions served as the comparator group. The Johns Hopkins University School of Medicine institutional review board approved the study. The data used in this study were taken from a national deidentified database intended for research purposes.

Information abstracted on patient demographic, clinical case-mix, and hospital characteristics included age (categorized as 16-25, 26-35, 36-45, 46-55, 56-65, 66-75, 76-85, and >85 years), sex, race/ethnicity (categorized as non-Hispanic white, non-Hispanic black, Hispanic, non-Hispanic other, and unknown), insurance status (public, private, uninsured, and unknown), month and year of admission, NIS-defined income quartile, disease severity (All Patient Refined Diagnosis Related Group [APR-DRG] risk of mortality subclasses, ranging from 0 to 4), comorbidities (Charlson comorbidity index,[15] categorized as 0, 1, 2, and ≥3), EGS diagnostic group (eTable 1 in the Supplement), and surgical procedure performed (eTable

Figure 1. Flow Diagram of the Study's Patient Selection Process



EGS indicates emergency general surgery; *ICD-9-CM*, *International Classification of Diseases, Ninth Revision, Clinical Modification*; and NIS, Nationwide Inpatient Sample.

2 in the Supplement). The APR-DRG risk of mortality is a measure of disease severity calculated by commercial health informatics entities working with the NIS.[16] The severity measure stratifies patients into assigned categories based on a proprietary algorithm, including disease diagnoses, age, comorbidities, procedures, and other clinically relevant variables. Calculated categories include none specified (0), minor (1), moderate (2), major (3), and extreme (4) risk of mortality.[17] Hospital-level variables included geographic location (categorized as Northeast, Midwest, West, and South), rural vs urban location, and NIS-determined bed size (small, medium, and large). Variables with missing observations (eg, race/ethnicity) had missing values recorded as a separate category to protect the integrity of the data set. Based on reported month of admission, included patients were dichotomized into patients managed early in the academic cycle (July and August) vs patients managed later (September-June).

Outcome measures included differences in in-hospital mortality, major complications, LOS, and total hospital cost. The NIS-provided total hospital charges were converted to costs using hospital cost to charge ratios for each year. These were then converted to 2014 US dollars using annual Hospital Consumer Price Indices.[18] Considered complications included secondary *ICD-9-CM*–defined pneumonia, pulmonary emboli, myocardial infarction, cardiac arrest, acute respiratory distress, sepsis, and septic shock. A secondary study population was used to assess for differences in the odds of developing a secondary EGS condition.

The NIS-provided design weights were used to account for clustering within hospitals and to attain weighted national effects. Within this weighted population, differences in demographic, clinical case-mix, and hospital-level characteristics were compared using descriptive statistics (the Pearson χ^2 test for categorical variables, 1-way analysis of variance for continuous age, and Kruskal-Wallis tests for nonnormally distributed continuous LOS and cost). Propensity scores were calculated to account for potential confounding and were used to adjust the risk in subsequent multivariable regression models comparing differences in outcomes between patients managed early in the academic cycle and patients managed late.

Propensity scores accounted for differences in age, sex, race/ethnicity, comorbidities, disease severity (as determined by the APR-DRG risk of mortality), year of admission, and insurance status. In addition to propensity scores, a direct risk adjustment further accounted for differences in hospital-level factors (region, location, and bed size), surgical procedure, and EGS diagnostic category. Logistic regression models were used for dichotomous outcomes. Generalized linear modeling, followed by an estimation of marginal means, was used to obtain risk-adjusted differences in LOS and total hospital cost, per patient. To account for the potential influence of seasonal trends throughout the year, a subset analysis restricting the later (September-June) management group to patients treated from April to May, with June omitted as a transitional period, was also considered.

Trends in risk-adjusted mortality and complications rates were further considered by month throughout the year. To generate risk-adjusted rates and corresponding 95% CIs, ratios of observed events to expected events for each month were determined. Observed events were the number of events that occurred. Expected events were calculated using postestimation marginal commands following risk-adjusted models for the 2 outcome measures. Resulting observed to expected ratios were multiplied by the unadjusted overall probabilities of death and complications to attain adjusted effects.

All statistical analyses were conducted using Stata Statistical Software Release 12 (StataCorp LP). A 2-sided $P < .05$ was considered statistically significant.

Results

A total of 1 433 528 patients were included, weighted to represent 7 095 045 patients from 581 (549 urban and 32 rural) teaching hospitals nationwide. Of these 1 433 528 patients with a primary EGS condition, 252 373 (17.6%) presented early in the academic year, whereas 1 181 155 (82.4%) were managed late. Complete demographic, case-mix, and hospital characteristics are presented by time of patient presentation in **Table 1** (observed frequencies; weighted percentages). Despite statistical significance, the majority of variables were comparable between the 2 groups.

Table 2 presents the relative odds of presenting with a specific EGS diagnostic condition early vs late. Disease presentations during the early management period (July and August) were again largely comparable to presentations later in the year. Patients who were cared for during the early academic cycle were more likely to present with soft-tissue disorders (odds ratio [OR], 1.10 [95% CI, 1.09-1.11]) and appendiceal pathologies (OR, 1.04 [95% CI, 1.02-1.06]). They were marginally less likely to present with a need for tracheostomies, gastrointestinal bleeding, a need for gastrostomy care, and vascular disorders, among others (Table 2). The most notable declines were observed for gastrointestinal bleeding (OR, 0.92 [95% CI, 0.90-0.93]) and intestinal obstructions (OR, 0.95 [95% CI, 0.94-0.96]).

Differences in risk-adjusted outcomes are presented in **Table 3**. In contrast to the worse outcomes anticipated by the July phenomenon, EGS patients managed in July and August had comparable, if not marginally better, risk-adjusted odds of mortality (OR, 0.96 [95% CI, 0.92-0.99]) and complications (OR, 0.98 [95% CI, 0.96-0.99]) relative to EGS patients managed later in the year. Among patients admitted to teaching hospitals for an unrelated primary diagnosis, the risk-adjusted odds of developing a secondary EGS condition were also lower among patients managed early vs late (OR, 0.97 [95% CI, 0.95-0.98]). There were no significant differences noted in terms of LOS and total hospital cost among patients with primary EGS conditions. Analyses restricted to patients who underwent a surgical procedure revealed similar results (Table 3).

Risk-adjusted outcomes in a subset analysis comparing patients treated early in the academic cycle (July and August) with patients treated exclusively in the months of April and May again revealed no difference between the 2 groups ($P > .05$) (eTable 3 in the Supplement). When considered by month

Table 1. Patient Demographic, Clinical Case Mix, and Hospital-Level Characteristics

Characteristic	Patients, No. (%) Overall (N = 1 433 528)	Academic Cycle Early (July-August) (n = 252 373)	Academic Cycle Late (September-June) (n = 1 181 155)	P Value[a]
Age, mean (SD), y	57.2 (19.6)	56.8 (19.5)	57.3 (19.6)	<.01
Age group, y				
16-25	95 280 (6.7)	17 141 (6.8)	78 139 (6.6)	<.01
26-35	133 415 (9.3)	24 105 (9.5)	109 310 (9.3)	
36-45	177 936 (12.4)	31 667 (12.6)	146 269 (12.4)	
46-55	255 577 (17.8)	45 793 (18.2)	209 784 (17.8)	
56-65	245 719 (17.2)	43 055 (17.1)	202 664 (17.2)	
65-75	215 681 (15.1)	37 630 (14.9)	178 051 (15.1)	
76-85	206 287 (14.4)	35 513 (14.1)	170 774 (14.5)	
>85	102 597 (7.2)	17 299 (6.9	85 298 (7.2)	
Female sex	95 280 (53.7)	17 141 (53.6)	78 139 (53.7)	.11
Race				
Non-Hispanic white	775 653 (54.1)	136 251 (54.0)	639 402 (54.1)	<.01
Non-Hispanic black	197 920 (13.8)	35 128 (13.9)	162 792 (13.8)	
Hispanic	133 745 (9.4)	24 389 (9.7)	109 356 (9.3)	
Other	73 478 (5.2)	12 601 (5.1)	60 877 (5.2)	
Unknown	252 732 (17.5)	44 004 (17.3)	208 728 (17.6)	
Insurance status				
Private	485 696 (33.9)	85 610 (33.9)	400 086 (33.9)	<.01
Government	826 039 (57.7)	144 268 (57.2)	681 771 (57.8)	
Uninsured	118 873 (8.2)	22 102 (8.7)	96 771 (8.1)	
Unknown	2920 (0.2)	393 (0.2)	2527 (0.2)	
Income quartile, $				
0-25	385 692 (26.8)	68 406 (27.0)	317 286 (26.8)	<.01
26-50	323 330 (22.4)	56 913 (22.4)	266 417 (22.4)	
51-75	337 612 (23.5)	59 596 (23.6)	278 016 (23.5)	
76-100	353 845 (24.9)	61 550 (24.6)	292 295 (25.0)	
Unknown	33 049 (2.4)	5908 (2.4)	27 141 (2.4)	
Urban	1 388 753 (97.0)	244 411 (97.0)	1 144 342 (97.0)	.32
Geographical region				
Northeast	420 246 (30.3)	74 067 (30.3)	346 179 (30.2)	.17
Midwest	380 748 (26.6)	66 792 (26.5)	313 956 (26.6)	
South	404 354 (27.0)	71 562 (27.1)	332 792 (27.0)	
West	228 180 (16.2)	39 952 (16.1)	188 228 (16.2)	
Hospital bed size				
Small	217 360 (13.9)	38 264 (13.9)	179 096 (14.0)	.04
Medium	371 286 (26.3)	65 857 (26.5)	305 429 (26.3)	
Large	844 882 (59.7)	148 252 (59.5)	696 630 (59.8)	
APR-DRG risk of mortality subclass				
1	803 727 (56.1)	143 392 (56.8)	660 335 (55.9)	<.01
2	370 963 (25.9)	65 254 (25.9)	305 709 (25.9)	
3	191 390 (13.3)	32 658 (12.9)	158 732 (13.4)	
4	67 262 (4.7)	11 033 (4.4)	56 229 (4.8)	

(continued)

throughout the year, plots of the risk-adjusted rates of mortality (**Figure 2**A) and major complications (Figure 2B) reveal an overall reduction in EGS-associated mortality rates at teaching hospitals that extends from April to September (1.45-1.55 deaths per 100 patients). Mortality rates increased during the winter months from October to March (1.55-1.70 deaths per 100 patients). Complication rates, in contrast, stayed between 11.80 and 12.00 complications per 100 patients for much of the year, with a spike peaking toward 12.40 complications per 100 patients in November and December. Patterns for nonteaching

Table 1. Patient Demographic, Clinical Case Mix, and Hospital-Level Characteristics (continued)

Characteristic	Patients, No. (%) Overall (N = 1 433 528)	Academic Cycle Early (July-August) (n = 252 373)	Academic Cycle Late (September-June) (n = 1 181 155)	*P* Value[a]
Charlson comorbidity index				
0	710 001 (49.5)	126 180 (50.0)	583 821 (49.4)	<.01
1	328 357 (22.9)	57 495 (22.8)	270 862 (22.9)	
2	164 096 (11.5)	28 528 (11.3)	135 568 (11.5)	
≥3	231 074 (16.1)	40 170 (15.9)	190 904 (16.2)	
Surgical procedure	502 105 (35.0)	126 180 (34.6)	414 861 (35.1)	<.01
EGS condition after admission	599 506 (41.8)	103 486 (41.0)	496 020 (42.0)	<.01
LOS, median (IQR), d	4 (2-6)	4 (2-6)	4 (2-6)	<.01
Mortality	22 345 (1.6)	3623 (1.4)	18 722 (1.6)	<.01
Complications	171 195 (11.9)	28 887 (11.4)	142 308 (12.0)	<.01
Cost (2014), median (IQR), $	8520 (5156-14 642)	8403 (5084-14 467)	8545 (5171-14 682)	<.01

Abbreviations: APR-DRG, All Payer Refined Diagnosis Related Group; EGS, emergency general surgery; IQR, interquartile range; LOS, length of stay.

[a] Statistical significance set at $P < .05$.

hospitals reveal similar trends (Figure 2), albeit notably lower levels of complications throughout the year.

Discussion

The results of this analysis conducted among a national sample of surgical patients treated at US teaching hospitals suggest that, in contrast to the worse outcomes anticipated by the July phenomenon, EGS patients managed early in the academic year fared equally well, if not better, than patients managed later. Known to be associated with a high level of resident involvement,[9,19] the results for EGS patients add to a growing body of literature that has begun to call into question the veracity of assumptions regarding the July phenomenon.[1-3,5-8,20-26]

An evidence-based assessment of the July phenomenon emerged in 2007 when Englesbe et al[23] demonstrated heightened levels of morbidity and mortality during July and August among surgical patients treated at 18 hospitals (14 academic medical centers) during the period from 2001 to 2004. Among a number of hypothesized explanations, the authors suggested that the influx of new surgical residents at the beginning of the academic cycle might have an important effect.[23] Subsequent work in 2009 among Medicare patients treated exclusively at academic centers revealed a lack of significant mortality differences.[27]

Some subsequent studies[1,9,25] pointed to increases in adverse surgical outcomes during July and August. They showed a 12% difference in mortality between elderly patients with hip fractures treated during the period from 1998 to 2003 at teaching vs nonteaching hospitals, 30% increased odds of mortality among patients undergoing complex cardiac surgery at a single institution in the United Kingdom during new resident rotations (July-August and January-February) during the period from 1996 to 2006 (differences in coronary artery bypass graft procedures were not significant), and an increase in the number of medical errors and complications at a single level I trauma center (which did not affect mortality) in the United States in July and August during the period from 2002 to 2006.

Table 2. Relative Odds of Presenting With a Specific EGS Condition During the Months of July and August[a]

EGS Disease Category	OR (95% CI)
Genitourinary pathology	1.14 (0.84-1.55)
Soft-tissue disorders	1.10 (1.09-1.11)[b]
Appendiceal disorders	1.04 (1.02-1.06)[b]
Abdominal pain	1.01 (0.99-1.03)
Pancreatic disorders	1.01 (0.99-1.03)
Biliary disorders	1.00 (0.99-1.01)
Fistula	1.00 (0.96-1.04)
Peritonitis	0.99 (0.97-1.02)
Colorectal disorders	0.98 (0.97-0.99)[b]
Gastrointestinal cancer	0.98 (0.96-0.99)[b]
Resuscitation	0.98 (0.95-1.01)
Peptic ulcer disease	0.97 (0.95-0.99)[b]
Cardiothoracic disorders	0.97 (0.93-0.99)[b]
Enteritis	0.96 (0.95-0.98)[b]
Hernias	0.96 (0.94-0.97)[b]
Other gastrointestinal disorders	0.96 (0.93-0.98)[b]
Intestinal obstruction	0.95 (0.94-0.96)[b]
Hepatic disorders	0.95 (0.90-1.01)
Retroperitoneal disorders	0.95 (0.85-1.06)
Vascular disorders	0.94 (0.92-0.97)[b]
Gastrostomy	0.93 (0.88-0.97)[b]
Gastrointestinal bleeding	0.92 (0.90-0.93)[b]
Tracheostomy	0.89 (0.82-0.97)[b]

Abbreviations: EGS, emergency general surgery; OR, odds ratio.

[a] Patients managed later in the academic cycle (September-June) are the reference.

[b] $P < .05$.

In contrast, data refuting the existence of the July phenomenon have demonstrated a lack of significant effects among cardiac patients,[4,7,21] patients admitted to the intensive care unit,[5] patients with appendicitis,[6] patients undergoing obstetric procedures,[7] patients undergoing complex neurosurgical

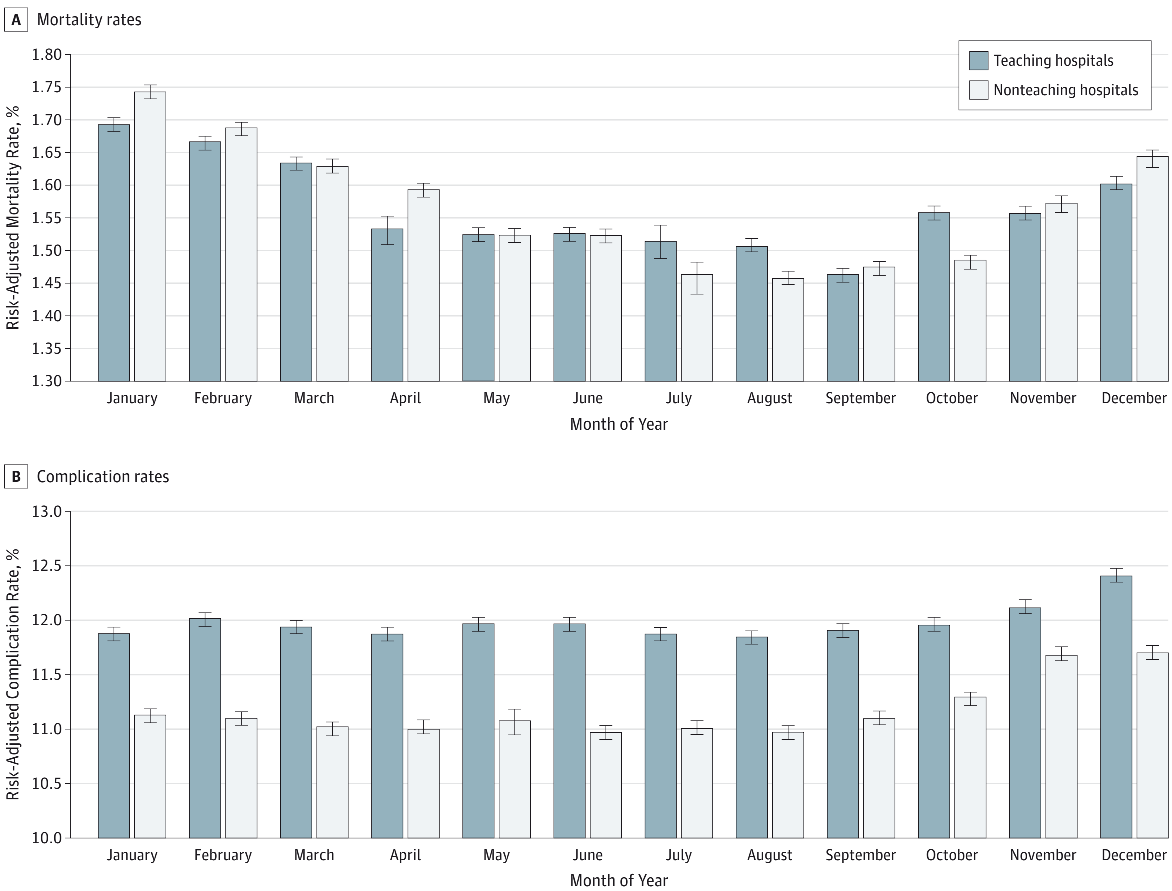
Table 3. Risk-Adjusted Differences in Outcomes Between the Early and Late Academic Cycles[a]

Factor	Odds Ratio (95% CI) Overall (N = 1 433 528) Early (July-August) (n = 252 373)	Overall Late (September-June) (n = 1 181 155)	Patients Who Underwent Surgery (n = 502 105) Early (July-August) (n = 87 244)	Patients Who Underwent Surgery Late (September-June) (n = 414 861)
Mortality	0.96 (0.92-0.99)	1 [Reference]	0.94 (0.89-1.01)	1 [Reference]
Complications	0.98 (0.96-0.99)	1 [Reference]	0.99 (0.96-1.03)	1 [Reference]
EGS condition after admission	0.97 (0.95-0.98)	1 [Reference]	0.98 (0.96-0.99)	1 [Reference]
Length of stay, d	5.23 (5.20-5.25)	5.27 (5.26-5.28)	6.64 (6.59-6.69)	6.70 (6.68-6.73)
Cost (2014), $	13 465 (13 408-13 523)	13 383 (13 357-13 410)	20 481 (20 335-20 626)	20 266 (20 201-20 330)

Abbreviation: EGS, emergency general surgery.

[a] Adjusted for age, sex, race/ethnicity, insurance status, income quartile, year of admission, diagnostic category, hospital region, location, bed size, surgical procedure, and disease severity.

Figure 2. Risk-Adjusted Rates of Mortality (A) and Complications (B) for Each Month of the Year



Risk adjusted for propensity score quintile, hospital location, geographical region, hospital bed size, surgical procedure, and emergency general surgery category. Subset analysis on nonteaching hospitals was performed on 1 963 442 patient records from 2557 nonteaching hospitals. Error bars indicate 95% CIs.

procedures,[2,8] and, now, a national sample of patients from 581 teaching hospitals receiving EGS care.

While logical in theory given the lack of experience available to beginning surgeons, the overwhelming conclusion from the literature, even among studies showing evidence of some "July effect"[8,9] (and supported by our results) is that there is a failure to substantiate the claims behind the July phenomenon. It is time to debunk the myth.

As a constituent of acute care surgery, EGS heavily relies on acute care services for patient management, providing an opportunity for a "hands-on" surgical experience for many junior residents.[16,17] Rather than worsening patient outcomes, the results reveal significantly, albeit marginally, improved outcomes among EGS patients managed early vs later in the academic year. If assumed to be clinically informative, these results suggest that, in emergency conditions, the presence of additional trainees early in the academic year may actually provide an "optimal increase" in manpower required to manage patients.[28] Beyond inexperienced interns, the start of the academic year brings with it the arrival of many extra pairs of motivated and detail-oriented hands. Whether hypervigilance on the part of attending physicians, staff member, and senior residents or cautious initiative from junior residents and new fellows,[27] the lack of mortality-reaching effects appears clear. However, the possibility for increased near misses and medical errors, demonstrated among trauma patients by Inaba et al,[3] remains.

Differences in outcomes can also potentially be partially explained by differences in disease presentations during the summer and winter months. An examination of specific EGS diagnostic conditions in our study demonstrated that a majority of complex EGS conditions present less often to teaching hospitals during the mid to late summer months (July and August) (Table 2). Patients were more likely to present with disease conditions such as appendiceal pathologies and soft-tissue disorders, which historically have carried a lower risk of mortality and complications.[29-34] Higher overall risk-adjusted rates of mortality and complications (Figure 2) peaked during the winter months (November and December) at both teaching and nonteaching hospitals, suggesting a possibly still greater role for seasonality beyond the July phenomenon during the winter holiday months. Future studies are warranted to consider the extent to which the inverse effect of the July phenomenon: how graduating chief residents and fellows, outgoing preliminary surgical residents, and generally short-staffed holiday surgical crews could influence the outcomes that patients experience.

Our study has some limitations that need to be considered, and they are primarily centered on our study's reliance on administrative data. While use of the NIS provides the ability to ascertain national-level effects from a large number (n = 581) of teaching hospitals across the United States, including important characteristics about the hospitals themselves, it lacks access to certain aspects of more detailed clinical and biological data. Information on the level of resident participation and supervision in both operative and management decisions was similarly unavailable. An additional limitation is the lack of a standardized disease severity measure for EGS conditions. The APR-DRG risk of mortality, provided in the NIS, combined with the comorbidity assessment via the Charlson comorbidity index, offers a valid, albeit arguably imperfect, proxy.

Conclusions

The results of our study add to a growing body of surgical literature demonstrating a lack of evidence to support the existence of the July phenomenon. Beyond debunking the myth for emergency surgery procedures, the results suggest that an increase in surgical manpower and the potential for hypervigilance among surgeons, trainees, and staff overseeing new surgical recruits may actually supersede trainee inexperience, leading to marginally better outcomes for patients managed early in the academic year.

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Critical revision of the manuscript for important intellectual content: Shah, Zogg, Nitzschke, Havens, Salim, Cooper, Haider.
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Invited Commentary

Debunking the July Phenomenon
Are We Asking the Right Questions?

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Heightened concern for patient safety emerges each July with the influx of new medical trainees and the transition of current residents to new roles. Referred to as *the July phenomenon*, this time period, and the potential association with increased medical error, remains a highly debated topic in the field of medicine and in society. To date, studies show conflicting results; many question whether this phenomenon really exists. In 2006, Englesbe et al[1] showed an increase in surgical morbidity and mortality during July and August using risk-adjusted National Surgical Quality Improvement Program data. Yet no difference during this time period was seen in a 2011 study by Elhert et al,[2] who also used National Surgical Quality Improvement Program data to examine the 10 most common general surgery procedures. The existing literature in the fields of trauma,[3] cardiac surgery,[4] and obstetrics[5] also refutes the existence of a July phenomenon.

Related article page 217

A study by Shah et al[6] in this issue of *JAMA Surgery* adds to this body of literature by examining temporal variations in morbidity and mortality among emergency general surgery patients. Their study included 1 433 528 emergency general surgery patients treated in urban and rural teaching hospitals. They show that patients managed during the early period (July and August) had equivalent if not lower rates of risk-adjusted mortality (odds ratio, 0.96 [95% CI, 0.92-0.99]) and complications (odds ratio, 0.98 [95% CI, 0.96-0.99]) compared with the cohort of emergency general surgery patients managed later in the year (September-June). Interestingly, when monthly data were analyzed, both risk-adjusted morbidity and mortality spiked during the winter months.

This study[6] provides additional evidence that the July phenomenon may be no more than hospital lore. However, as noted by Shah et al,[6] it is possible that the threat of a July phenomenon resulted in increased oversight early in the academic year and prevented the myth from becoming a reality. In contrast, a disturbing finding observed in this study and noted previously in the literature was the increased frequency of surgical complications and the increased mortality during the winter months.[2]

It is well documented that patients experience more severe medical illness during the winter months, including increased rates of stroke, sepsis, and cardiac arrest[7]; however, it is unclear how this may also affect the surgical population. If our goal is to improve patient outcomes, perhaps we should shift our focus from July to January. What factors contribute to worse surgical outcomes in the winter? Are patients sicker or presenting less expediently? Are holiday schedules compromising