

The “weekend effect” in urgent general operative procedures

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Background. *There is growing concern that the quality of inpatient care may differ on weekends versus weekdays. We assessed the “weekend effect” in common urgent general operative procedures.*

Methods. *The Healthcare Cost and Utilization Project Florida State Inpatient Database (2007–2010) was queried to identify inpatient stays with urgent or emergent admissions and surgery on the same day. Included were patients undergoing appendectomy, cholecystectomy for acute cholecystitis, and hernia repair for obstructed/gangrenous hernia. Outcomes included duration of stay, inpatient mortality, hospital-adjusted charges, and postoperative complications. Controlling for hospital and patient characteristics and type of surgery, we used multilevel mixed-effects regression modeling to examine associations between patient outcomes and admissions day (weekend vs weekday).*

Results. *A total of 80,861 same-day surgeries were identified, of which 19,078 (23.6%) occurred during the weekend. Patients operated on during the weekend had greater charges by \$185 ($P < .05$), rates of wound complications (odds ratio [OR] 1.29, 95% confidence interval [95% CI] 1.05–1.58; $P < .05$), and urinary tract infection (OR 1.39, 95% CI 1.05–1.85; $P < .05$). Patients undergoing appendectomy had greater rates of transfusion (OR 1.43, 95% CI 1.09–1.87; $P = .01$), wound complications (OR 1.32, 95% CI 1.04–1.68; $P < .05$), urinary tract infection (OR 1.76, 95% CI 1.17–2.67; $P < .01$), and pneumonia (OR 1.41, 95% CI 1.05–1.88; $P < .05$). Patients undergoing cholecystectomy had a greater duration of stay ($P = .001$) and greater charges ($P = .003$).*

Conclusion. *Patients undergoing weekend surgery for common, urgent general operations are at risk for increased postoperative complications, duration of stay, and hospital charges. Because the cause of the “weekend effect” is still unknown, future studies should focus on elucidating the characteristics that may overcome this disparity. (Surgery 2015;158:508-14.)*

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THE “WEEKEND EFFECT” refers to inferior outcomes for patients hospitalized on the weekend compared with the weekday. This effect is described in the medical and operative literature in a wide variety of conditions, including myocardial infarction, pulmonary embolism, childbirth, and intracerebral hemorrhage.¹⁻⁴ Although mortality serves as a proxy for the weekend effect in many studies, the literature portrays a wide-reaching effect with worse outcomes in many

aspects of weekend care. These include patient outcomes such as duration of stay (DOS) and complications, as well as process quality measurements including cost, time to endoscopy in gastrointestinal hemorrhage, use of laparoscopy over open approaches, and waiting time.⁴⁻¹⁶

Studies regarding the weekend effect in the operative literature consistently demonstrate substandard outcomes for emergent and elective operative indications during the weekend.^{6-8,10,13-16} The effect likely involves operative performance and perioperative care as both weekend surgery and Friday surgery, with weekend care were associated with inferior outcomes compared with weekday equivalents. Zare et al⁷ found greater 30-day mortality in patients operated on Friday versus Monday through Wednesday, whereas Worni et al¹⁰ found patients undergoing urgent surgery for diverticulitis had a greater risk of Hartman procedure and complications if admitted on the weekend.

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Especially problematic is the weekend effect in common urgent procedures that comprise the “bread and butter” of most general surgeons’ repertoire and require prompt operative management to achieve optimal outcomes.¹⁷⁻¹⁹ Procedures such as appendectomy, cholecystectomy for acute cholecystitis, and hernia repair for obstructed/gangrenous hernia are common procedures that any hospital-based operative practice should be able to manage on weekdays and the weekend. Because of the frequency of these conditions and the morbidity and cost associated with added complications, we aimed to characterize the weekend effect in this population by using a large, administrative, all-payer dataset. We hypothesized that patients undergoing urgent common general operations on the weekend would have lesser operative outcomes, mortality, cost, and DOS compared with patients who were operated on a weekday, after adjusting for patient and hospital characteristics.

METHODS

The Healthcare Cost and Utilization Project (HCUP) State Inpatient Database (SID) from Florida was queried for years 2007–2010. The SID is an administrative, all-payer database aggregated by the Agency for Healthcare Research and Quality. The Institutional Review Board at our institution deemed the study exempt from review because the data is deidentified and publically available.

Each inpatient observation included *International Classification of Diseases, 9th Revision, Clinical Modification*, codes corresponding to procedures and diagnoses recorded during the stay. Other relevant data elements were the day of the operative procedure, time of admission (weekend vs weekday), type of admission (urgent, emergent), and whether specific diagnoses were present on admission.

Included were inpatient stays for patients who underwent appendectomy, cholecystectomy for acute cholecystitis, or hernia repair for obstructed/gangrenous hernia. Only those with an admission classified as emergent or urgent and received surgery on the same day as admission were included in the patient population (Fig 1). Patients were grouped on the basis of time of hospital admission (weekend vs weekday), which also corresponded to date of surgery as all patients had surgery on date of admission.

We extracted demographic data from the HCUP-SID, including age, sex, race, type of admission (urgent or emergent), insurance status

(Medicare, Medicaid, private payer, not insured), type of surgery (appendectomy, cholecystectomy, hernia repair), laparoscopic surgery (Y/N), year, pediatric (Y/N), and the number of chronic conditions. Hospital characteristics were the size (>100 beds), profit status, and location (urban or rural) of the hospital to which patients were admitted. The number of chronic conditions was tabulated by HCUP and defined as a condition that lasts 12 months or longer and meets one or both of the following tests: (1) it places limitations on self-care, independent living, and social interactions; (2) it results in the need for ongoing intervention with medical products, services, and special equipment.

Mortality and DOS were assessed along with the charges of the inpatient stay adjusted for the average charges of each hospital. To adjust for charge, HCUP creates a ratio of single hospital charges to the average nationwide hospital charges that is multiplied to the charges of each inpatient stay. Postoperative complications were defined as the acquisition of an *International Classification of Diseases, 9th Revision, Clinical Modification*, code corresponding to the specific complication during the course of the stay that was not present upon admission to the hospital. Assessed were wound complications, blood transfusion, sepsis, pneumonia, and urinary tract infection (UTI). Complication groupings were modified from Worni et al.¹⁰

Statistical methods. We compared baseline demographics, hospital characteristics, and outcomes between patients who underwent weekend versus weekday surgery by using the Pearson’s χ^2 test for categorical variables and the Student *t* test and Kruskal-Wallis tests for normally and non-normally distributed continuous variables, respectively.

Multilevel mixed-effects logistic regression modeling was used to examine the association between dichotomous patient outcomes and admissions day (weekday vs weekend) while nesting patients within hospitals. Generalized linear modelling was used to examine the association between continuous patient outcomes and admission day and used a gamma distribution to control for non-normal skew of outcomes.

Both the multilevel, mixed-effects logistic regression model and the generalized linear model controlled for age, sex, race, insurance status, type of surgery, laparoscopic surgery (Y/N), pediatric (Y/N), number of chronic conditions, as well as hospital size, profit status and urban versus rural location. The model controlled for these covariates regardless of the level of

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