There were 175,313 neurosurgical cases (137,029 spine, 38,284 cranial) identified. A total of 23,723 (13.5%) patients developed a complication and 2588 (1.5%) patients died. Compared with spine surgery, cranial surgery had higher likelihood of any complication (22.2% vs. 11.1%; P<0.001) and mortality (4.8% vs. 0.5%; P<0.001). In multivariable analysis, cranial surgery had 2.73 times higher likelihood for mortality compared with spine surgery (95% confidence interval, 2.46-3.03; P<0.001), but demonstrated lower odds of any complication (odds ratio, 0.93; 95% confidence interval, 0.90-0.97; P<0.001). There were 6 predictors (race, tobacco use, dyspnea, chronic obstructive pulmonary disease, chronic heart failure, and wound classification) significantly associated with any complication, but not mortality. Paradoxically, tobacco use had an unexplained protective effect on at least one complication or any complication. Similarly, increasing body mass index was protective for any complication and mortality, which suggests there may be a newly observed “obesity paradox” in neurosurgery. CONCLUSIONS: After controlling for demographic characteristics, preoperative comorbidities, and perioperative factors, cranial surgery had higher risk for mortality compared with spine surgery despite lower risk for other complications. These findings highlight a discrepancy in the risk for postoperative complications following neurosurgical procedures that requires emphasis within quality improvement initiatives \(^1\).

Of 94,621 NSQIP-reported neurosurgical patients from 2006 to 2013, 2325 (2.5 %) developed post-operative respiratory failure. Of these patients, 1270 (54.6 %) were male, with an overall mean age of 60.59 years; 571 (24.56 %) were current smokers and 756 (32.52 %) were ventilator-dependent. Past medical history included dyspnea in 204 patients (8.8 %), COPD in 198 (8.5 %), and congestive heart failure in 66 (2.8 %). The rate of post-operative respiratory failure decreased from 4.1 % in 2006 to 2.1 % in 2013 (p < 0.001). Of the 2325 patients with respiratory failure, 1061 (45.6 %) underwent unplanned intubation post-operatively and 1900 (81.7 %) were ventilator-dependent for more than 48 h. The rate of both unplanned intubation (p < 0.001) and ventilator dependence (p < 0.001) decreased significantly from 2006 to 2013. Multivariate analysis demonstrated that significant risk factors for respiratory failure included inpatient status (p < 0.001, OR = 0.165), age (p < 0.001, OR = 1.014), diabetes (p = 0.001, OR = 1.489), functional dependence prior to surgery (p < 0.001, OR = 2.081), ventilator dependence (p < 0.001, OR = 10.304), hypertension requiring medication (p = 0.005, OR = 1.287), impaired sensorium (p < 0.001, OR = 2.054), CVA/stroke with or without neurological deficit (p < 0.001, OR = 2.662; p = 0.002, OR = 1.816), systemic sepsis (p < 0.001, OR = 1.916), prior operation within 30 days (p = 0.026, OR = 1.439), and operation type (cranial relative to spine, p < 0.001, OR = 4.344, Table 4).

Based on the NSQIP database, risk factors for respiratory failure after neurosurgery include pre-operative ventilator dependence, alcohol use, functional dependence prior to surgery, stroke, and recent operation. The overall rate of respiratory failure decreased from 4.1 % in 2006 to 2.1 % in 2013 according to these data \(^2\).
coma can decrease length and cost of hospitalization, improve patient functional status and decrease morbidity and mortality.

Larsen et al performed a search of the ACS-NSQIP database for all patients undergoing an operation with a surgeon whose primary specialty was neurological surgery from 2006 to 2013. Of 94,546 neurosurgical patients reported, there were 687 (0.71%) cases of post-operative stroke and coma. The annual rate of coma longer than 24 hours decreased from 0.90% in 2006 to 0.002% in 2013 (p<0.001), while the annual rate of stroke decreased from 1.2% in 2006 to 0.5% in 2013 (p=0.013). Multivariate analysis demonstrated that inpatient status (p=0.001), age (p=0.005, OR=1.012), history of diabetes (p=0.017, OR=1.515), ventilator dependence (p<0.001, OR=4.379), impaired sensorium (p<0.001, OR=2.314), history of coma longer than 24 hours (p<0.001, OR=2.655), hemiparesis (p=0.022, OR=1.492), CVA/stroke with neurological deficit (p<0.001, OR=2.091), CVA/stroke without neurological deficit (p=0.001, OR=2.44), and tumor involving CNS (p<0.001, OR=2.928) are significant risk factors for developing post-neurosurgical stroke and coma.

The rate of post-neurosurgical stroke decreased from 1.2% in 2006 to 0.5% in 2013 and the rate of post-neurosurgical coma greater than 24 hours decreased from 0.9% in 2006 to 0.002% in 2013. Ten risk factors for developing post-neurosurgical stroke and coma were identified using multivariable analysis. These risk factors should be assessed pre-operatively and incorporated into clinical decision making so individuals whom are at higher risk for the development of stroke and coma can be appropriately monitored during the post-operative period.

Lieber et al compared 30-day postoperative outcomes of neurosurgery performed by surgical teams that included resident physicians in training during the first academic quarter (Q1, July through September) with outcomes of neurosurgery performed with resident participation during the final academic quarter (Q4, April through June), using 2006-2012 data from the prospectively collected American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database. Regression analyses were performed on outcome data that included mortality, surgical complications, and medical complications, which were graded as mild or severe.

To determine whether a July Effect was present in subgroups, secondary analyses were performed to analyze the association of outcomes with each major neurosurgical subspecialty, the postgraduate year of the operating resident, and the academic quarter during which the surgery was performed. To control for possible seasonal trends in certain diseases, the authors compared patient outcomes at academic medical centers to those at community-based hospitals, where procedures were not performed by residents. In addition, the efficiency of academic centers was compared to that of community centers in terms of operative duration and total length of hospital stay.

Overall, there were no statistically significant differences in mortality, morbidity, or efficiency between the earlier and later quarters of the academic year, a finding that also held true among neurosurgical subspecialties and among postgraduate levels of training. There was, however, a slight increase in intraoperative transfusions associated with the transitional period in July (6.41% of procedures in Q4 compared to 7.99% in Q1 of the prior calendar year; p = 0.0005), which primarily occurred in cases involving junior (2nd- to 4th-year) residents. In addition, there was an increased rate of reoperation (1.73% in Q4 to 2.19% in Q1; p < 0.0001) observed mainly among senior (5th- to 7th-year) residents in the early academic months and not paralleled in our community cohort.
There is minimal evidence for a significant July Effect in adult neurosurgery.

The results suggest that, overall, the current resident training system provides enough guidance and support during this challenging transition period.


