

## Introduction

The American College of Surgeons NSQIP Surgical Risk Calculator (SRC) was a tool developed to use 21 individual patient characteristics to make predictions for occurrence of 13 general and 2 procedure specific outcomes. Literature on the role of NSQIP SRC in spine surgery is sparse.

## Methods

The American College of Surgeons (ACS) National Surgical Quality Improvement Project (NSQIP) user file for 2015 was queried for patients above the age of 18 undergoing single level posterior lumbar fusion surgery. Individual patient characteristics were entered into the online risk calculator interface to retrieve the predicted estimated risk for perioperative outcomes and complications including surgical site infection, readmissions, reoperations, major complication, any complication and mortality. Following this, predictive performance was analyzed by computing brier score, c-statistic and sensitivity values for all observed outcomes.

### 30 day outcomes following single-level posterior lumbar fusion

Outcome	Frequency
Any complication* (n, %)	177(6.3)
Serious complication†(n, %)	201(7.1)
Surgical Site Infection (n, %)	66(2.35)
<i>Superficial incisional SSI</i>	31(1.1)
<i>Deep incisional SSI</i>	24(0.85)
<i>Organ space SSI</i>	11(0.39)
Urinary tract infection (n, %)	50(1.78)
Venous thromboembolism (n, %)	26(0.9)
Readmission (n, %)	144(5.13)
Return to OR (n, %)	95(3.38)

\* defined as superficial incisional SSI, deep incisional SSI, organ space SSI, wound disruption, pneumonia, unplanned intubation, pulmonary embolism, ventilator > 48 hours, progressive renal insufficiency, acute renal failure, UTI, stroke, cardiac arrest, myocardial infarction, DVT, systemic sepsis)

† defined as death, cardiac arrest, myocardial infarction, pneumonia, progressive renal insufficiency, acute renal failure, pulmonary embolism, deep venous thrombosis, deep incisional SSI, organ space SSI, systemic sepsis, unplanned intubation, UTI

## Results

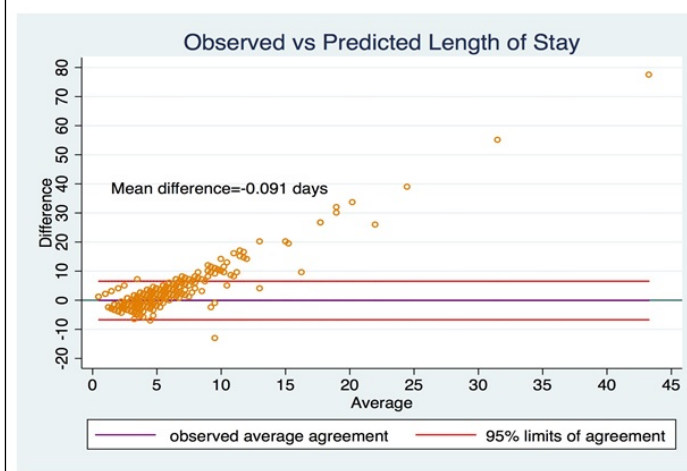
A total of 2808 patients were included in the analysis with 53.7% (1510) females. Overall, a very low incidence of 30-day postoperative complications was observed with the procedure (0.9%-6.3%). Poor predictive performance was found for all outcomes including readmissions (c-statistic=0.63, sensitivity=15.28%, brier score=0.048) and returns to OR (c-statistic=0.63, sensitivity=15.28%, brier score=0.048). The best performance was observed for venous thromboembolism (c-statistic=0.66, brier score=0.008) although sensitivity was poor (3.85%) on account of low incidence. Predictive performance for length of stay revealed good agreement between observed and predicted values with the exception of prolonged predicted hospital stays (>3.5 days).

### Discrimination, Sensitivity values and Brier Scores for ACS risk prediction model

Outcome	Discrimination(c-statistic)	Sensitivity (%)	BS	Maximum BS	Scaled BS
Return to OR	0.559	21.05	0.032	0.032	29.88
SSI	0.634	42.42	0.023	0.023	42.58
Readmission	0.631	15.28	0.048	0.048	19.70
Serious Complication	0.612	20.40	0.063	0.071	13.15
Any complication	0.61	17.51	0.0692	0.077	11.99
VTE	0.6594	3.85	0.008	0.013	76.15
UTI	0.6237	38.0	0.0164	0.016	58.18

BS- Brier score; UTI- Urinary tract infection; SSI- surgical site infection; VTE- Venous thromboembolism

### Bland-Altman plot representing agreement between observed and predicted length of stay



## Discussion

In this study, we assessed the performance of NSQIP-SRC for a homogenous population of patients undergoing posterior lumbar fusion. We found that the model does not adequately predict the outcomes of return-to-OR (c-statistic=0.56, brier score=0.032, maximum brier score=0.032), readmission (c-statistic=0.63, brier score=0.023, maximum brier score=0.023). We found that the model performed poorly for SSI (c-statistic=0.634, brier score=0.048, maximum brier score=0.048). Our results partially agree with those of Vaziri et al who employed the SRC for 1006 of their institutional cases of patients undergoing a neurosurgical procedure and found that it had a poor discriminative performance for return to OR (c-statistic= 0.45) and SSI (c-statistic= 0.55) while it was good for VTE (c=76) and UTI (c=0.84). Veeravagu et al found a discriminatory performance of 0.55 for predicting any complication using the SRC in patients undergoing spine surgery. Our results also agree with studies that have assessed the performance of SRC in other surgical specialties. Goltz et al assessed the performance of SRC in patients undergoing total knee arthroplasty (TKA) and total hip arthroplasty (THA) and found an adequate discriminatory value for predicting discharge to a skilled nursing facility (SNF) (c-statistic= 0.72) and DVT (c-statistic=0.70), but suboptimal for predicting return to OR (c-statistic= 0.59) & SSI (c-statistic= 0.66). O'Neil et al assessed the SRC to predict complications in patients undergoing microsurgical breast reconstruction and found a poor discriminatory performance (c-statistic = 0.54).

## Conclusions

To the best of our knowledge, this is the first study which has assessed the performance of the NSQIP-SRC for a homogenous population of patients undergoing a single level posterior lumbar fusion. Although the calculator did not fare well in predicting most outcomes, results need to be interpreted in the context of the low incidence rate of such outcomes.