

Accurate Parsimonious Prediction of Postoperative Discharge Destination

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INTRODUCTION: With inpatient length of stay decreasing, discharge destination after operation can serve as an important metric for quality of care. Adequate planning requires a multidisciplinary approach starting hospital day 1, reduces healthcare costs, and ensures patient needs are met. The Surgical Risk Preoperative Assessment System (SURPAS) shared decision-making tool is a parsimonious model using 8 predictor variables developed from the American College of Surgeons NSQIP data set. The SURPAS is applicable to more than 3,000 operations in 9 surgical specialties, predicts various postoperative outcomes, and is incorporated into our electronic health record.

METHODS: A “full model” for risk of postoperative “discharge not to home” was developed from 28 non-laboratory preoperative variables from American College of Surgeons NSQIP 2012 to 2017 data set using logistic regression. This was compared with the 8-variable SURPAS model using the c-index as a measure of discrimination, the Hosmer-Lemeshow observed-to-expected plots testing calibration; and the Brier score, a combined metric of discrimination and calibration.

RESULTS: Of 4,154,833 patients, 336,388 (8.82%) experienced a discharge not to home. The SURPAS model’s c-index, 0.914, was 99.2% of the full model’s 0.921; the Hosmer-Lemeshow plots indicated good calibration (see Figure); and the Brier score was 0.0537 and 0.0514 for the SURPAS and full model, respectively.

CONCLUSIONS: The 8-variable SURPAS model preoperatively predicts risk of postoperative discharge to a destination other than home as accurately as the 28 non-laboratory American College of Surgeons NSQIP full model. Therefore, discharge destination can be integrated into the existing SURPAS tool with accuracy to guide decision making and help prepare patients for their postoperative recovery.



Artificial Intelligence Outperforms Clinical Judgment in Triage for Postoperative ICU Care: Prospective Preliminary Results

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INTRODUCTION: The decision of admitting a stable patient to the ICU after major operation currently relies on clinical judgment and local hospital policies. We programmed an artificial intelligence (AI) to determine the appropriate level of care after major operation and compared its performance with clinician’s judgement.

METHODS: ICU admission was deemed “appropriate” when at least 1 of 15 criteria (eg re-intubation, prolonged hypotension, new-onset arrhythmia) was observed. Using Institutional data (512 patients, 87 clinical variables), we programmed an AI to predict when ICU admission would have been appropriate. We prospectively evaluated whether surgeon, anesthesiologist, intensivist, or AI was the most accurate predictor in determining appropriateness of ICU admissions across 50 patients undergoing major surgery (general, vascular, urological). Accuracy of predictions was compared using receiver operating characteristic curve analysis.

RESULTS: ICU care was appropriate (at least 1 of 15 objective criteria met) in 9 of 50 patients. Artificial intelligence correctly triaged to the appropriate level of care 82% of patients (surgeon 70%, anesthesiologist 58%, intensivist 64%). Receiver operating characteristic curve analysis revealed that AI’s triage was the most accurate (area under the curve [AUC] 0.82), followed by anesthesiologist’s (AUC 0.70), intensivist’s (AUC 0.69), and surgeon’s (AUC 0.60). Overall, clinicians leaned toward over-triaging patients to the ICU (Table).

Table. Performance of Clinicians and Artificial Intelligence in Triaging Postoperative Patients to the ICU

Variable	Surgeon	Anesthesiologist	Intensivist	Artificial intelligence
Correct triage, n (%)	35 (70)	29 (58)	32 (64)	41 (82)
Incorrect triage, n (%)	15 (30)	21 (42)	18 (36)	9 (18)
Under-triage, n (%)	5 (10)	1 (2)	2 (4)	6 (12)
Over-triage, n (%)	10 (20)	20 (40)	16 (32)	3 (6)
Positive predictive value, %	29	29	30	50
Negative predictive value, %	87	95	93	86

Hosmer-Lemeshow Partition Graphs with Fit Statistics for the a) Full 28 Variable Model and b) Eight Variable (SURPAS) Model.

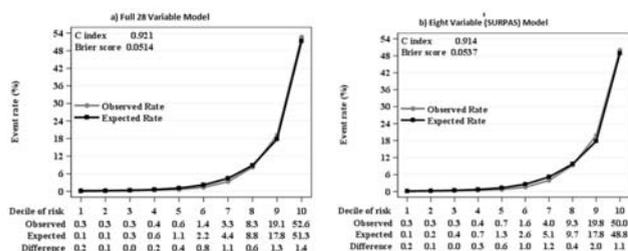


Figure.

CONCLUSIONS: Our study provides the first evidence that AI can have a role in supporting clinical decisions on postoperative triage. In the future, more sophisticated platforms can become integrated in daily clinical practice.

Assessment of Non-Routine Events During Intubation for Pediatric Trauma

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INTRODUCTION: Delayed endotracheal intubation is associated with a 6-fold-higher risk of mortality in the early post-injury phase. We identified and characterized workflow interruptions (non-routine events [NREs]) contributing to time delays during pediatric trauma intubations.

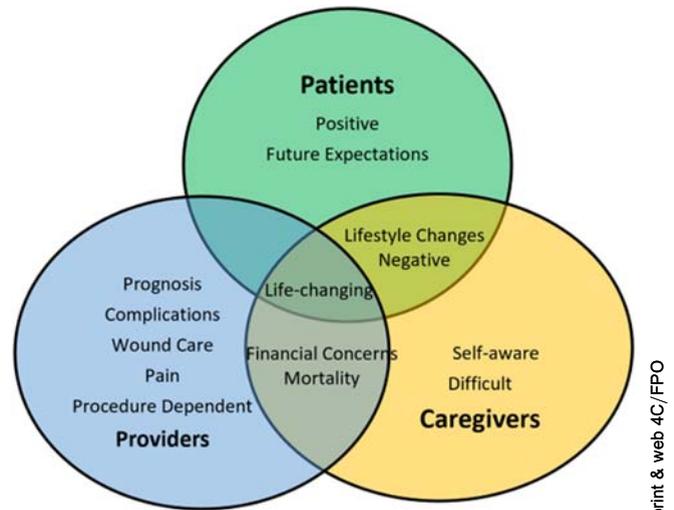
METHODS: We reviewed videos of trauma intubations occurring in the emergency department at a Level I pediatric trauma center from 2014 to 2018. We identified and classified NREs occurring between the decision to intubate and the initial laryngoscopy attempt ("time to intubation"). We evaluated the association of the number and type of NREs with the indication for intubation (traumatic brain injury with Glasgow Coma Scale score <8, cardiac arrest, airway protection, respiratory distress).

RESULTS: Among the 34 pediatric (mean \pm SD 5.6 ± 4.9 years) trauma intubations, the most common indication was Glasgow Coma Scale score <8 ($n = 20$ [58.8%]). Median time to intubation was 7.5 minutes (interquartile range 5 minutes; range 1.4 to 27.5 minutes) with a median of 7.4 NREs per case (interquartile range 6; range 2 to 28) and a frequency of 1.1 NREs/min overall. Thirty-six (14.3%) NREs directly involved the process of intubation, including poor positioning, endotracheal tube manipulation, and laryngoscope blade change or unavailability. Intubations associated with cardiac arrest had fewer intubation-related NREs (0.2 ± 0.4 vs 1.3 ± 1.2 ; $p = 0.02$), and those for airway protection had more of these NREs (2.2 ± 0.8 vs 0.9 ± 1.1 ; $p = 0.009$).

CONCLUSIONS: Workflow disruption from non-routine events was common during the process of pediatric trauma intubation, differing in number and type based on the indication for intubation. Interventions focusing on teamwork and coordinating equipment during airway management might have the greatest impact on reducing the impact of NREs in this setting.

Assessment of Patient, Caregiver, and Clinician Perspectives on the Post-Discharge Phase of Care

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Figure. Participant Responses when Asked about the effect of Surgery on the Patient's Life

INTRODUCTION: Surgical care has shifted from the hospital to the home, such that daily care responsibilities have fallen to patients and their caregivers. The purpose of this study was to elicit from patients, caregivers, and healthcare providers their perceptions about recovery at home to inform personalization of care in the learning health system.

METHODS: Surgical oncology patients, caregivers and, clinicians participated in freelist, an anthropological technique of open-ended interviewing used to identify essential elements of a domain within a group. Participants were queried within 2 weeks post-discharge on home independence, social support, pain control, and the global impact of surgery. Salience indices, measures of the most important words within domains of interest, were calculated using Anthropac by domain and group.

RESULTS: Forty patients (20 white and 20 African American), 30 caregivers (17 white and 13 African American), and 20 providers (8 residents, 4 nurses, 4 advanced practitioners, and 4 attending surgeons) were interviewed. Patients and caregivers discussed the recovery experience, and providers described activities and individuals associated with recovery. All groups described the operation as life-changing, with providers and caregivers specifying concerns (Figure). Patients shared similar thoughts about their social support and self-care ability by race but differed in perception of the recovery process and pain management. African-American caregivers expressed positive responses more broadly than white caregivers.

CONCLUSIONS: Patients focus on recovery in the immediate post-discharge phase and caregivers and providers are more concerned with implications of the underlying problem. Among patients and caregivers, African Americans were more positive than whites.