



Harnessing AI and Video Analytics for Surgical Performance:

The OR Black Box® Explorer™ Module as a Platform for Learning and Quality Improvement

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Objective

To evaluate the utility of the OR Black Box Explorer Module—an AI-driven video analytics platform—in enhancing surgical education, coaching, and systems-level quality improvement (QI) across multiple international centers.

Project Overview

Structured video review in minimally invasive surgery improves technical performance, operative outcomes, and learner satisfaction (Daniel et al., Surg Endosc, 2023; Anderson et al., World J Surg, 2025). These data support systematic integration of video analysis into surgical education, quality improvement (QI), and AI-enabled research.

Methods: Multicenter Implementation and Prospective Cohort

Multicenter Descriptive Implementation (North America & Europe)

- Deployment across residency and specialty programs
- Integration into academic half-days and plenary sessions
- Evaluation of engagement and self-assessment accuracy on entrustable professional activities (EPAs)

Stanford Prospective Cohort (ACS Clinical Congress 2025)

- General surgery residents with structured video review rounds
- Evaluation of engagement and self-assessment accuracy on entrustable professional activities (EPAs)
 - Standardized expert video
 - Self-review
 - Peer video
 - Attending-coach review
- Likert scale (1 = not at all, 5 = extremely) helpfulness assessment
- Three-way t-test analysis

OR Black Box Explorer Module



Autonomous operative video capture with AI procedure segmentation, instrument identification, and blood detection



Implemented across residency programs for self-assessment, peer learning, and department- wide QI



Web- and mobile-based review, tagging, and clip sharing for coaching and feedback



Enables individualized education through clip libraries, in-video commenting, and faculty-led review sessions

Stanford Prospective Cohort: Comparison of Video Review Rounds

(1 = not at all, 2 = slightly, 3 = moderately, 4 = very, 5 = extremely)

Round	Overall Mean Helpfulness (SD)	Three-way t-test	
		t(df=24)	Two-sided p
Standardized expert video	2.9 (1.8)	REF	REF
Peer video	3.3 (1.3)	0.622	0.54
Self-review only	4.2 (0.9)	2.205*	0.041
Attending coach	4.9 (0.4)	769*	<0.001

*Levene’s p<0.001; Equal variances not assumed

Preliminary Results

- Structured video review integrated into resident academic half-days to evaluate self-assessment accuracy and faculty feedback
- Strong learner engagement with operative video review
- Improved accuracy of resident self-assessment on Entrustable Professional Activities
- Institution-wide trainee video libraries implemented with weekly faculty-led plenary review sessions
- Fostered an open, psychologically safe learning culture
- Thoracic Surgery:
 - Peer discussion of complex cases and intraoperative decision-making
- Pediatric Surgery:
 - Laparoscopic and overhead video integrated into nurse training
 - Accelerated workflow familiarization and procedural understanding
- Stanford Prospective Cohort (ACS Clinical Congress 2025):
 - Unanimous support for routine video integration
 - Strongest preference for coach-led sessions (mean 4.9/5, p<0.001)

Conclusions and Future Directions

- Future work will quantify performance metrics, expand AI-driven event detection, and assess impact across elective, trauma, and acute care surgery settings
- The Black Box Explorer module demonstrates significant potential for scalable surgical education, peer coaching, and QI
- Early experience shows enhanced engagement and institutional learning.

