CORRESPONDENCE

Performance assessment and clinical experience (PACE) scorecards for anesthesiology residents: a post-implementation physician survey

Alexander J. Lingley, MSc · Ryan McGinn, MD, MSc · Christopher L. Pysyk, MD · Gregory L. Bryson, MD, MSc · Daniel G. Dubois, MD

Received: 7 July 2020 / Revised: 9 July 2020 / Accepted: 10 July 2020 / Published online: 23 July 2020
© Canadian Anesthesiologists' Society 2020

To the Editor,

Paralleling adoption of competency-based medical education and electronic health records (EHRs) has spurred interest in developing novel tools for the evaluation of physician performance. The use of EHRs allows multiple process and patient outcome metrics to be employed for educational improvement initiatives. The objective nature of automated performance analysis stands to provide a valuable adjunct to subjective feedback, the current predominant form of evaluation in clinical education.

Self-documented logs are commonly employed to audit resident learning experiences and infer progression towards competency. Nevertheless, a pilot project at our institution revealed disparity in cumulative clinical exposure tracked between logbooks and an EHR.¹ To explore the utility of EHRs in clinical evaluation, we provided a scorecard summarizing annual clinical activities and performance of anesthesiology residents at the University of Ottawa (Figure). Data were extracted from the Anesthesia Information Management System (AIMS). A similar scorecard was previously developed for staff anesthesiologists at The Ottawa Hospital.²

An existing post-implementation survey, which assessed staff anesthesiologists' perceptions of performance scorecards, was modified for this study.² Our survey comprised 11 items including seven Likert scales (ranging from strongly disagree to strongly agree) and four qualitative questions (eAppendix in the Electronic Supplementary Material). Four volunteers validated the survey using the Burns clinical sensibility tool. Scorecards and survey invitations were distributed via email to all enrolled anesthesiology residents in June 2019 ($n = 42$). This study was approved on 22 July 2019 by The Ottawa Health Science Network Research Ethics Board (OHSN-REB; 20,190,124-01H); participation was voluntary and responses were anonymized.

Using a modified Dillman method,³ we obtained a response rate of (17/42; 40%). Most residents agreed/strongly agreed that the scorecards were personally interesting (15/17; 88%), valuable for professional development (13/17; 76%), an effective measure of clinical experience (12/17; 71%), and influential for future practice (12/17; 71%). Most residents also agreed/strongly agreed that scorecards were preferable to logbooks (12/17; 71%) but only 41% (7/17) of respondents agreed/strongly agreed that scorecards were an effective measure of clinical performance.

The benefits of EHR-derived assessment are several-fold. Applying quantitative data to indicators of care enables self-assessment of performance and experience relative to peers or training program goals. Scorecards are cost-effective and relieve clerical burden associated with manual logging. Additionally, passive feedback may positively influence practice behaviours as serial administration of similar scorecards was associated with more frequent administration of intraoperative anti-emetics and reduced postoperative nausea/vomiting in a previous

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s12630-020-01766-6>) contains supplementary material, which is available to authorized users.

A. J. Lingley, MSc
Faculty of Medicine, University of Ottawa, Ottawa, ON, Canada

R. McGinn, MD, MSc · C. L. Pysyk, MD ·
G. L. Bryson, MD, MSc · D. G. Dubois, MD (✉)
Department of Anesthesiology and Pain Medicine, University of
Ottawa, Ottawa, ON, Canada
e-mail: dadubois@toh.ca

Figure Sample anesthesiology resident performance assessment and clinical experience (PACE) scorecard for postgraduate years (PGY) 1–5. Data were extracted from a perioperative electronic health record, the Anesthesia Information Management System (AIMS). Gray column shows departmental totals at The Ottawa Hospital (TOH) for comparison

TOH Anesthesia Resident Scorecard

VARIABLE	TOH 2017-2018 25,379	PGY1 2013-2014	PGY2 2014-2015	PGY3 2015-2016	PGY4 2016-2017	PGY5 2017-2018	TOTAL (Individual)
Campus							
Civic	9,824 (38.7%)	78 (78.0%)	93 (41.0%)	54 (40.0%)	72 (35.3%)	90 (60.0%)	
General	10,558 (41.6%)	9 (9.0%)	134 (59.0%)	81 (60.0%)	106 (52.0%)	9 (6.0%)	
Riverside	4,997 (19.7%)	13 (13.0%)	0 (0.0%)	0 (0.0%)	26 (12.7%)	51 (34.0%)	
Age	57.0 (42.0-69.0)	60.0 (42.5-68.5)	58.0 (43.0-70.0)	59.0 (48.0-68.0)	61.0 (44.5-71.5)	52.5 (36.0-67.0)	
Gender							
Female	14,159 (55.8%)	57 (57.0%)	118 (52.0%)	77 (57.0%)	105 (51.5%)	92 (61.3%)	
Priority							
Elective	17,953 (70.7%)	50 (50.0%)	112 (49.3%)	74 (54.8%)	95 (46.6%)	108 (72.0%)	439
Urgent	5,578 (22.0%)	38 (38.0%)	93 (41.0%)	40 (29.6%)	92 (45.1%)	29 (19.3%)	292
Work-in	1,848 (7.3%)	12 (12.0%)	22 (9.7%)	21 (15.6%)	17 (8.3%)	13 (8.7%)	85
ASA							
I	2,958 (11.7%)	10 (10.0%)	18 (7.9%)	14 (10.4%)	17 (8.3%)	25 (16.7%)	84
II	8,565 (33.7%)	33 (33.0%)	64 (28.2%)	30 (22.2%)	52 (25.5%)	53 (35.3%)	232
III	11,191 (44.1%)	39 (39.0%)	106 (46.7%)	79 (58.5%)	97 (47.5%)	51 (34.0%)	372
IV	2,548 (10.0%)	18 (18.0%)	38 (16.7%)	12 (8.9%)	38 (18.6%)	19 (12.7%)	125
V	88 (0.3%)	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	2 (1.3%)	3
VI	23 (0.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0
Unknown	6 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0
Surgeon Service							
Orthopaedic Surgery	6,133 (24.2%)	22 (22.0%)	50 (22.0%)	27 (20.0%)	50 (24.5%)	60 (40.0%)	209
General Surgery	4,905 (19.3%)	18 (18.0%)	49 (21.6%)	22 (16.3%)	48 (23.5%)	19 (12.7%)	156
Urology	3,608 (14.2%)	6 (6.0%)	22 (9.7%)	9 (6.7%)	42 (20.6%)	17 (11.3%)	96
Vascular Surgery	1,349 (5.3%)	6 (6.0%)	17 (7.5%)	8 (5.9%)	12 (5.9%)	2 (1.3%)	45
Gynecology	3,071 (12.1%)	3 (3.0%)	29 (12.8%)	7 (5.2%)	13 (6.4%)	22 (14.7%)	74
Neurosurgery	1,388 (5.5%)	12 (12.0%)	7 (3.1%)	21 (15.6%)	5 (2.5%)	14 (9.3%)	59
Thoracic Surgery	767 (3.0%)	0 (0.0%)	25 (11.0%)	1 (0.7%)	13 (6.4%)	0 (0.0%)	39
ENT/Otolaryngology	1,482 (5.8%)	4 (4.0%)	6 (2.6%)	3 (2.2%)	6 (2.9%)	9 (6.0%)	28
Plastic Surgery	955 (3.8%)	0 (0.0%)	1 (0.4%)	2 (1.5%)	0 (0.0%)	4 (2.7%)	7
Dental Surgery	433 (1.7%)	0 (0.0%)	7 (3.1%)	27 (20.0%)	11 (5.4%)	3 (2.0%)	48
Gyne Oncology	473 (1.9%)	0 (0.0%)	3 (1.3%)	6 (4.4%)	2 (1.0%)	0 (0.0%)	11
Ophthalmology	762 (3.0%)	0 (0.0%)	11 (4.8%)	1 (0.7%)	2 (1.0%)	0 (0.0%)	14
Other	39 (0.2%)	0 (0.0%)	0 (0.0%)	1 (0.7%)	0 (0.0%)	0 (0.0%)	1
Anesthesiology	11 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0
Route of Admission							
Surgical Day Care	11,807 (46.5%)	34 (34.0%)	63 (27.8%)	31 (23.0%)	52 (25.5%)	75 (50.0%)	
Inpatient	6,275 (24.7%)	43 (43.0%)	100 (44.1%)	51 (37.9%)	101 (49.5%)	33 (22.0%)	
Overnight Surgical Day Care	1,486 (5.9%)	10 (10.0%)	11 (4.8%)	4 (3.0%)	9 (4.4%)	9 (6.0%)	
Same Day Admit	5,811 (22.9%)	13 (13.0%)	53 (23.3%)	49 (36.3%)	42 (20.6%)	33 (22.0%)	
Time of Day							
Daytime (7:00am-2:59pm)	22,429 (88.4%)	79 (79.0%)	172 (75.8%)	114 (84.4%)	152 (74.5%)	131 (87.3%)	648
Evening (3:00pm-11:59pm)	274 (1.0%)	17 (17.0%)	51 (22.5%)	17 (12.6%)	47 (23.0%)	16 (10.7%)	148
Overnight (12:00am-6:59am)	276 (1.1%)	4 (4.0%)	4 (1.8%)	4 (3.0%)	5 (2.5%)	3 (2.0%)	20
Day of the Week							
Monday	4,124 (16.2%)	29 (29.0%)	27 (11.9%)	24 (17.8%)	34 (16.7%)	17 (11.3%)	
Tuesday	5,022 (19.8%)	13 (13.0%)	38 (16.7%)	29 (21.5%)	35 (17.2%)	35 (23.3%)	
Wednesday	5,071 (20.0%)	9 (9.0%)	47 (20.7%)	24 (17.8%)	32 (15.7%)	39 (26.0%)	
Thursday	5,127 (20.2%)	14 (14.0%)	38 (16.7%)	24 (17.8%)	45 (22.1%)	19 (12.7%)	
Friday	4,642 (18.3%)	20 (20.0%)	45 (19.8%)	18 (13.3%)	35 (17.2%)	38 (25.3%)	
Saturday	707 (2.8%)	12 (12.0%)	14 (6.2%)	8 (5.9%)	12 (5.9%)	1 (0.7%)	
Sunday	686 (2.7%)	3 (3.0%)	18 (7.9%)	8 (5.9%)	11 (5.4%)	1 (0.7%)	
Antibiotics and Warming Compliance							
Cases Given Cefazolin	24,205 (95.4%)	75 (75.0%)	205 (90.3%)	128 (94.8%)	199 (97.5%)	141 (94.0%)	
Cefazolin Given within 60 min of Incision	22,898 (94.6%)	64 (64.0%)	196 (86.5%)	121 (94.5%)	187 (94.0%)	137 (97.2%)	
Cases Eligible for Re-dose Cefazolin	1,728 (6.8%)	8 (8.0%)	19 (8.4%)	21 (15.6%)	22 (10.8%)	13 (8.7%)	
Cefazolin Re-dosed < 4 hours	1,660 (6.6%)	8 (8.0%)	19 (8.4%)	20 (15.2%)	22 (10.8%)	13 (8.7%)	
Cases Considered for Normothermia Compliance	17,711 (69.8%)	70 (70.0%)	154 (67.8%)	125 (92.6%)	179 (87.7%)	106 (70.7%)	
Cases Reaching Normothermia (Temp >= 36)	14,677 (58.3%)	43 (43.0%)	131 (58.1%)	119 (88.2%)	167 (81.3%)	91 (60.0%)	
Medications Given During a Clinical Session							
Ketamine	8,267 (32.6%)	24 (24.0%)	58 (25.6%)	66 (48.9%)	132 (64.7%)	84 (56.0%)	
Ketorolac	3,051 (12.0%)	17 (17.0%)	31 (13.7%)	21 (15.6%)	15 (7.4%)	15 (10.0%)	
Ondansetron	18,450 (72.7%)	69 (69.0%)	145 (63.9%)	108 (80.0%)	153 (75.0%)	116 (77.3%)	
Haloperidol	4,633 (18.3%)	12 (12.0%)	21 (9.3%)	23 (17.0%)	25 (12.3%)	29 (19.3%)	
Dexamethasone	15,602 (61.5%)	49 (49.0%)	102 (44.9%)	85 (63.0%)	98 (48.0%)	106 (70.7%)	
Celecoxib	9,707 (38.2%)	29 (29.0%)	72 (31.7%)	25 (18.5%)	37 (18.1%)	69 (46.0%)	
Outcomes							
Pain Score on Arrival	0.0 (0.0-3.0)	0.0 (0.0-3.0)	0.0 (0.0-4.0)	0.0 (0.0-5.0)	0.0 (0.0-3.0)	0.0 (0.0-3.0)	
Maximum Pain	3.0 (0.0-5.0)	3.0 (0.0-5.0)	3.0 (0.0-5.0)	4.0 (1.0-6.0)	2.5 (0.0-5.0)	2.0 (0.0-4.5)	
PAR Score on Arrival	12.0 (11.0-12.0)	12.0 (11.0-13.0)	12.0 (11.0-13.0)	12.0 (11.0-12.0)	12.0 (11.0-12.0)	12.0 (11.0-12.0)	
Time from First PAR to First PAR=13	24.0 (3.8-54.2)	22.8 (0.8-83.8)	29.7 (0.0-66.0)	33.2 (14.0-81.3)	39.0 (12.3-73.8)	30.8 (7.5-59.5)	
Vomit and Nausea Assessment Documented	24,443 (96.3%)	94 (94.0%)	210 (92.5%)	129 (95.6%)	194 (95.1%)	143 (95.3%)	770
Nauseated During Clinical Session	4,042 (16.5%)	15 (16.0%)	41 (19.5%)	24 (18.6%)	40 (20.6%)	22 (15.4%)	142
Vomited During Clinical Session	442 (1.8%)	3 (3.2%)	7 (3.3%)	7 (5.4%)	5 (2.6%)	3 (2.1%)	25
Number of Adverse Events Reported in SIMS	336 (1.3%)	0 (0.0%)	5 (2.2%)	1 (0.7%)	2 (1.0%)	2 (1.3%)	
Procedures							
Number of Arterial Lines Placed	1,128 (4.4%)	5 (5.0%)	6 (2.6%)	4 (3.0%)	10 (4.9%)	3 (2.0%)	28
Number of Central Lines Placed	230 (0.9%)	2 (2.0%)	4 (1.8%)	2 (1.5%)	7 (3.4%)	2 (1.3%)	17
Alternate Airway: Glidescope	3,296 (13.0%)	10 (10.0%)	20 (8.8%)	28 (20.7%)	32 (15.7%)	22 (14.7%)	112
Alternate Airway: McCoy (3 and 4 blades)	98 (0.4%)	0 (0.0%)	2 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2
Alternate Airway: Eschmann Stylet (Bougie)	229 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.7%)	1
Alternate Airway: Fiberoptic Intubation	395 (1.6%)	0 (0.0%)	8 (3.5%)	6 (4.4%)	5 (2.5%)	1 (0.7%)	20
Cases with Spinal Placed for Main Procedures	2,352 (9.3%)	12 (12.0%)	22 (9.7%)	5 (3.7%)	14 (6.9%)	11 (7.3%)	64
Cases with Epidural Placed (Epidural alone or Combined GA/Epidural) for Main Procedures	775 (3.1%)	1 (1.0%)	8 (3.5%)	11 (8.1%)	9 (4.4%)	2 (1.3%)	31
Neuromuscular Blocking (NMB) Medications and Neuromuscular Transmission (NMT) Monitoring by Train of Four (TOF)							
Number (%) of all cases with "General Anesthesia" (GA) in Anesthesia Type	18,737 (73.8%)	79 (79.0%)	176 (77.5%)	110 (81.5%)	155 (76.0%)	107 (71.3%)	
Number (%) of total GA cases NMB given WITH OR WITHOUT TOF value in anesthesia record	13,127 (70.1%)	61 (77.2%)	142 (80.7%)	94 (85.5%)	114 (73.5%)	78 (72.9%)	
Number (%) of total GA cases NMB given and TOF readings present on anesthesia record	5,110 (38.9%)	21 (34.4%)	70 (49.3%)	76 (80.9%)	92 (80.7%)	27 (34.6%)	
Number (%) of total GA cases NMB given and TOF 90-100% recorded prior to extubation	3,238 (71.6%)	8 (47.1%)	42 (70.0%)	51 (72.9%)	58 (73.4%)	16 (80.0%)	
Number (%) of total GA cases NMB given AND documented NMT by use "Equipment Event" set "Peripheral Nerve Stimulator"	6,219 (47.4%)	17 (27.9%)	46 (32.4%)	76 (80.9%)	86 (75.4%)	46 (59.0%)	
Eye Pain Management Protocol Scanned into Oasis	53 (0.2%)		0 (0.0%)	0 (0.0%)	2 (1.0%)	1 (0.7%)	
The following variables apply to inpatients only							
Number of Inpatient Cases	13,777 (54.3%)	65 (65.0%)	163 (71.8%)	104 (77.0%)	152 (74.5%)	74 (49.3%)	
Charlson Index							
0	9,147 (66.4%)	45 (69.2%)	91 (55.8%)	51 (49.0%)	84 (55.3%)	58 (78.4%)	
1-2	3,128 (22.7%)	15 (23.1%)	42 (25.8%)	32 (30.8%)	46 (30.3%)	11 (14.9%)	
3-4	733 (5.3%)	3 (4.6%)	20 (12.3%)	11 (10.6%)	8 (5.3%)	1 (1.4%)	
5+	769 (5.6%)	2 (3.1%)	10 (6.1%)	10 (9.6%)	14 (9.2%)	4 (5.4%)	
Length of Stay							
Length of Stay (Days)	3.0 (1.0-8.0)	4.0 (2.0-11.0)	4.0 (2.0-10.0)	4.0 (2.0-9.5)	6.0 (2.0-13.5)	3.0 (2.0-8.0)	
Actual Length of Stay (ALOS) to Estimated Length of Stay (ELOS) Ratio	0.93 (0.89, 0.96)	0.97 (0.46, 2.09)	0.89 (0.58, 1.35)	0.98 (0.69, 1.36)	0.98 (0.69, 1.37)	0.94 (0.52, 1.68)	
Mortality & Readmissions							
Crude mortality	232 (1.7%)	1 (1.5%)	3 (1.8%)	4 (3.8%)	3 (2.0%)	2 (2.7%)	13
Unplanned 30-day Readmission	930 (7.0%)	5 (7.9%)	14 (8.9%)	9 (9.3%)	20 (13.6%)	2 (2.8%)	50

study.⁴ The ability to include patient outcome data, which was completely deidentified and compliant with the Ontario Patient Privacy Act, provides tangible feedback to residents on the most clinically relevant aspects of their practice.

Despite advantages, the acceptability of scorecards as a measure of performance was low in our cohort and among staff anesthesiologists at the same institution.² A previous qualitative study identified limitations to acceptance of EHR-based assessment.⁵ Foremost was perceived incompleteness of data and the tendency to falsely attribute outcomes to an individual, masking team-level contributions.⁵ These limitations highlight the importance of employing EHR-mediated assessment adjunctively with other modalities including direct observation for comprehensive trainee evaluation.

In summary, this study indicates potential utility of EHR-derived scorecards during anesthesiology training. Serial administration with monitoring and coaching via academic advisors may inform whether scorecards influence practice behaviours or correlate with progression through residency. If so, the trajectory of residents and programs could be estimated with appropriate interventions enacted to improve medical education and quality of care.

Disclosures None.

Funding statement Funding was provided by Department of Innovation in Medical Education, University of Ottawa, Ottawa ON and University of Ottawa Faculty of Medicine Summer Student Bursary.

Editorial responsibility This submission was handled by Dr. Hilary P. Grocott, Editor-in-Chief, *Canadian Journal of Anesthesia*.

References

1. McGinn R, Lingley AJ, McIsaac DI, et al. Logging in: a comparative analysis of electronic health records versus anesthesia resident-driven logbooks. *Can J Anesth* 2020. <https://doi.org/10.1007/s12630-020-01761-x>
2. Wheeler K, Baxter A, Boet S, Pysyk C, Bryson GL. Performance feedback in anesthesia: a post-implementation survey. *Can J Anesth* 2017; 64: 681-2
3. Thorpe C, Ryan B, McLean SL, et al. How to obtain excellent response rates when surveying physicians. *Fam Pract* 2009; 26: 65-8
4. Pysyk CL, Corsi DJ, Boet S. The potential for anesthesiologist practice feedback to reduce postoperative vomiting in an academic centre. *Can J Anesth* 2019; 66: 609-10.
5. Sebok-Syer SS, Goldszmidt M, Watling CJ, Chahine S, Venance SL, Lingard L. Using electronic health record data to assess residents' clinical performance in the workplace: the good, the bad, and the unthinkable. *Acad Med* 2019; 94: 853-60.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.