

PLSC – SIMPL Research Letter of Intent

Procedural Learning and Safety Collaborative

PLSC – SIMPL Form: RLOI 7-14-2016

Date of Submission: 5/7/18

Title of Proposed Project: Mapping Resident Learning Curves

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Is your Academic Home a PLSC collaborator? yes

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For PLSC – SIMPL Use

PLSC SIMPL Research Letter of Intent Received \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PLSC SIMPL Research Letter of Intent Approved\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

IRB Proposal and Approval Letter Received\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PLSC SIMPL Signed Data Use Agreement Received\_\_\_\_\_\_\_\_\_\_\_\_\_

**PLSC – SIMPL Research Letter of Intent**

Title of Proposed Project: Mapping Resident Learning Curves

Provide a succinct description of your project by answering the following questions. This portion of your research letter of intent should not exceed 1-2 typewritten pages.

Background/Rationale for the Project

There is a clear correlation between surgeons’ technical skills and patient outcomes[1]. Yet, the American Board of Surgery (ABS) certification process involves no assessment of technical skill. The existing oral examination is unable to discern technical competence, as confirmed by the American Board of Colorectal Surgery[2] and the European Board of Surgery Qualification in Vascular Surgery[3] after incorporating skills stations into their certification processes.

Traditionally, the ABS has required residents to submit case logs of operations performed in residency. Minimum numbers within procedural categories are set by the Accreditation Council for Graduate Medical Education (ACGME) and the ABS. Deficiencies do not preclude individuals from graduation; they are considered only at the program level, at the time of ACGME re-accreditation. No one has definitively ascertained the minimum number of cases or years of experience needed to safely perform any particular operation; existing data demonstrates wide variability between individual resident learning curves, making the universal applicability of such minimums unlikely at best[4]. Case log data indicates substantial variability in resident operative experience with few repetitions of many key procedures[5].

The paucity of standardized, objective technical assessments begins in residency. Over the course of their 5 years in training, residents are each required to obtain only 6 operative performance assessments, and these evaluations are neither collected nor reviewed by the ABS[6]. Several rating instruments exist. The Zwisch scale assess resident operative autonomy on a 4 point scale. Interrater reliability and validity (via correlation with other rating systems) were demonstrated in a sample of 8 cases[7]. The Operative Performance Rating System (OPRS) asks raters to score residents on 4-5 procedure-specific and 5 general items. Interrater reliability and validity (based on the PGY level) was demonstrated in a sample of 8 cases. There is a high correlation of the scale with a single 5-point Likert-type item on overall performance[8].

System for Improving and Measuring Procedural Learning (SIMPL) is a mobile device platform that queries each resident and attending dyad about resident performance in a single operation: 1) the Zwisch scale, 2) the overall performance item of the OPRS, 3) the perceived complexity of the case, relative to other, similar procedures, and 4) optional open-format dictated feedback. It requires initiation by either the resident or the attending; both assessments must be completed within 72 hours of the operation.

Cumulative sum (CUSUM) is a control chart, typically used in manufacturing, designed to monitor deviations from a target. It has been previously used to chart learning curves for individual surgeons learning a single procedure[9,10]. We performed a CUSUM analysis of Zwisch scale data for Northwestern General Surgery residents over a period of 6 months in which SIMPL data was recorded for >90% of cases.

Specific Aims (Including Study Goals, Hypotheses and/or Research Questions) for the Project

We aim to expand this methodology over a multi-institutional sample to:

1. Perform CUSUM analyses of individual residents, using SIMPL data.

*H1: It is feasible to map learning curves for individual residents using SIMPL data.*

1. Perform aggregate CUSUM analyses for each PGY level to establish benchmarks for performance.

*H2: With the SIMPL data for multiple residents, norms for resident performance may be determined, allowing outliers to be identified in an objective fashion.*

Research Design and Methods for Achieving the Stated Aims. Describe concisely the research design, methods and analytic plan for achieving the stated goals.

We request 2 years of multi-institutional SIMPL data collected by PLSC to develop and refine our CUSUM analytic methodology. We will perform individual resident CUSUM analyses, followed by aggregate CUSUM analyses based upon PGY level. Finally, we will perform aggregate CUSUM analyses based upon program to assess for inter-institutional differences.

We have existing SAS and R code for CUSUM analyses; we will adapt these to the PLSC data and compare the 2 models to determine the best modality in terms of clarity/comprehensibility and scalability.

Value Added (Impact or Outcome)

How will your research add to:

1. Fundamental knowledge about trainee performance, practice or learning
2. Fundamental knowledge about trainee performance measurement, and assessment (interpretation)
3. The application of trainee performance knowledge to enhance educational or assessment practice

The surgical learning curve has never been mapped at the level of an individual trainee. The establishment of individual learning curves and guideposts for performance serve multiple educational goals:

1) to increase our understanding of resident education/progress under the existing training paradigm,

2) to be able to objectively demonstrate that residents have achieved a level of competence appropriate for safe independent practice,

3) to be able to objectively identify residents who may be in need of remediation or redirection,

4) to provide a baseline trajectory of learning against which to evaluate the impact of educational interventions,

5) to provide a justification and a methodology for new training paradigms in which graduation is based upon demonstration of competency rather than time invested.

The ultimate goal is to implement CUSUM analyses in a national cohort. We are requesting this subset of PLSC data to develop and refine our methodology before deploying in the Flexibility in Duty Hours Requirements for Surgical Trainees (FIRST) Trial cohort, which includes 118 General Surgery residency programs and is overseen by the Surgical Outcomes and Quality Improvement Center (SOQIC) at Northwestern, with support from the ABS, the ACGME, and the American College of Surgeons [11, 12].

**References**

1. Birkmeyer, J.D., et al., *Surgical skill and complication rates after bariatric surgery.* N Engl J Med, 2013. **369**(15): p. 1434-42.

2. de Montbrun, S., et al., *Implementing and Evaluating a National Certification Technical Skills Examination: The Colorectal Objective Structured Assessment of Technical Skill.* Ann Surg, 2016. **264**(1): p. 1-6.

3. Pandey, V.A., et al., *The examination assessment of technical competence in vascular surgery.* Br J Surg, 2006. **93**(9): p. 1132-8.

4. Stride, H.P., et al., *Relationship of procedural numbers with meaningful procedural autonomy in general surgery residents.* Surgery, 2017.

5. Bell, R.H., Jr., et al., *Operative experience of residents in US general surgery programs: a gap between expectation and experience.* Ann Surg, 2009. **249**(5): p. 719-24.

6. Surgery, A.B.o. *Resident Performance Assessments*. [cited 2018 4 January]; Available from: <http://www.absurgery.org/default.jsp?certgsqe_resassess>.

7. George, B.C., et al., *Reliability, validity, and feasibility of the Zwisch scale for the assessment of intraoperative performance.* J Surg Educ, 2014. **71**(6): p. e90-6.

8. Williams, R.G., et al., *A controlled study to determine measurement conditions necessary for a reliable and valid operative performance assessment: a controlled prospective observational study.* Ann Surg, 2012. **256**(1): p. 177-87.

9. Forbes, T.L., et al., *Cumulative sum failure analysis of the learning curve with endovascular abdominal aortic aneurysm repair.* J Vasc Surg, 2004. **39**(1): p. 102-8.

10. Okrainec, A., et al., *Defining the learning curve in laparoscopic paraesophageal hernia repair: a CUSUM analysis.* Surg Endosc, 2011. **25**(4): p. 1083-7.

11. Bilimoria, K.Y., et al., *National Cluster-Randomized Trial of Duty-Hour Flexibility in Surgical Training.* N Engl J Med, 2016. **374**(8): p. 713-27.

12. Bilimoria, K.Y., et al., *Development of the Flexibility in Duty Hour Requirements for Surgical Trainees (FIRST) Trial Protocol: A National Cluster-Randomized Trial of Resident Duty Hour Policies.* JAMA Surg, 2016. **151**(3): p. 273-81.

What information or assistance do you need from the Procedural Learning and Safety Collaborative? Be specific including the data required and the years of data.

We request 2 complete academic years of SIMPL data collected by PLSC. We need the following variables:

Program/programID

ProcID/procName

procStartTime/date

evalCompleted

Rater ID

SubjectID

RaterRole

SubjectRole

traineePGY

traineeType

supervision

performance

Date you intend to complete this project.

We anticipate that the analysis and refinement of methodology will take about 3 months after the data has been received.

You may attach one or two examples of related research you and your colleagues have completed if you wish.