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Residents' surgical performance during the laboratory years: an analysis of rule-based errors

*Jay N. Nathwani, MD, Brett J. Wise, BS, Margaret E. Garren, Hossein Mohamadipanah, PhD, Nicole Van Beek, Shannon M. DiMarco, BA, and Carla M. Pugh, MD, PhD**

Department of Surgery, University of Wisconsin-Madison, Madison, Wisconsin

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ABSTRACT

Background: Nearly one-third of surgical residents will enter into academic development during their surgical residency by dedicating time to a research fellowship for 1-3 y. Major interest lies in understanding how laboratory residents' surgical skills are affected by minimal clinical exposure during academic development. A widely held concern is that the time away from clinical exposure results in surgical skills decay. This study examines the impact of the academic development years on residents' operative performance. We hypothesize that the use of repeated, annual assessments may result in learning even without individual feedback on participants simulated performance.

Methods: Surgical performance data were collected from laboratory residents (postgraduate years 2-5) during the summers of 2014, 2015, and 2016. Residents had 15 min to complete a shortened, simulated laparoscopic ventral hernia repair procedure. Final hernia repair skins from all participants were scored using a previously validated checklist. An analysis of variance test compared the mean performance scores of repeat participants to those of first time participants.

Results: Twenty-seven (37% female) laboratory residents provided 2-year assessment data over the 3-year span of the study. Second time performance revealed improvement from a mean score of 14 (standard error = 1.0) in the first year to 17.2 (SD = 0.9) in the second year, ($F[1, 52] = 5.6$, $P = 0.022$). Detailed analysis demonstrated improvement in performance for 3 grading criteria that were considered to be rule-based errors. There was no improvement in operative strategy errors.

Conclusions: Analysis of longitudinal performance of laboratory residents shows higher scores for repeat participants in the category of rule-based errors. These findings suggest that laboratory residents can learn from rule-based mistakes when provided with annual performance-based assessments. This benefit was not seen with operative strategy errors and has important implications for using assessments not only for performance analysis but also as a learning experience.

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* *Corresponding author*. Department of Surgery, University of Wisconsin Hospital and Clinics, 600 Highland Avenue, WiSOR K6/135, Madison, WI 53792. Tel.: +1 608 263 5218; fax: +1 608 263 2354.
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Introduction

Up to one-third of surgical residents will choose to take time from clinical training for academic development. This is formally done by dedicating 1-3 y of study to research after completing one's second or third year of clinical training.[1-3] Motivation for entering research years may include, taking the first steps to establish an academic career, improving one's chances of achieving a competitive fellowship, mandatory regulation of training programs, or taking time for personal reasons.[2,3] Academic skill development may come in the form of progressing the critical thinking skills necessary for research, enrollment in research courses, and sharpening of grant and manuscript writing under the appropriate mentorship.[4]

Clinical responsibilities during times of academic development vary. Some programs will allow research residents to take no clinical responsibilities; however, most programs will implement mandatory clinical responsibilities during research years.[2,3,5] Outside of obligations to the respective training program, research residents may also be provided with opportunities to moonlight for financial gain or to maintain clinical skills.[2] Although clinical responsibilities play a role during resident research, little work has been done to understand the impact of research years on the clinical skills and knowledge developed or lost by residents during this time.

It is generally accepted that in the setting of research years, laboratory residents will encounter some level of surgical skills decay. Residents who re-enter the clinical years after completing a research fellowship are expected to return to clinicals with less knowledge and skill than when they left for research. One study that focused on perceived skill reduction found that laboratory residents also expected their skills to decay while in the laboratory years.[6] In contrast to residents who have been in research for 1 year, laboratory residents who were in research for 2 years expected an even greater skill decay.[7] The change in work responsibilities, limited clinical exposure, and self-perceived clinical skill reduction all leave to question the exact influence of laboratory years on surgical skills.

This study aims to investigate how the academic development years of surgical training impact technical and cognitive skills. We hypothesize that the use of repeated, annual assessments may result in learning even without individual feedback on participants' simulated performance.

Materials and methods

Setting and participants

This was a 3-year (2014-2016), longitudinal skills assessment study with primary interest in understanding how surgical skills decayed or evolved throughout laboratory years. Midwest general surgery training programs were contacted for involvement in the study. Inquiries were sent to resident education coordinators or program directors at respective sites. A total of nine programs agreed to participate over the span of 3 years of recruitment. The target population of the study was surgical residents entering their first year of academic development. Trainees already in academic development, however, were not excluded. Data were collected at the respective sites in the summer months of 2014, 2015, and 2016. All participation in this study was voluntary, and the study was approved by the University of Wisconsin Hospitals and Clinics Institutional Review Board.[8]

Research protocol

Participating residents first completed a demographic survey containing questions about gender, postgraduate year, clinical years completed, and on-call obligations during research, including moonlighting. Participants in the year 2016 were additionally asked if they had performed any preparation for the study prior to enrolling. With completion of the demographic survey, participants were escorted to the laparoscopic ventral hernia (LVH) repair station where they had a total of 15 min to complete an abbreviated LVH repair. A previously validated box trainer contained a 10 × 10 cm simulated hernia defect located 5 cm inferior to the umbilicus.[9] Participants were informed that two anchoring sutures had already been brought through the patient's skin and were instructed to complete the repair by retrieving and securing the last two sets of sutures and placing five tacks to secure the mesh to the abdominal wall.

A research assistant was trained to be an operative assistant. Participants were specifically instructed that the operative assistant could assist at the level of medical student and could not answer questions related to the procedure itself. Operative assistants were instructed they could drive the laparoscopic camera and perform instructions directly provided by the participant. All the tools necessary to complete the hernia repair were furnished.

Survey, audio, laparoscopic and external scene video data, operative times, and final hernia product score data were collected for later analysis. Hernia skins were assessed for completion and quality of repair using a previously validated checklist, which included both technical and cognitive performance measures. The checklist utilized is notably reflective of both simple rule-based errors related to the LVH repair and more complex steps requiring operative planning.[9,10] A maximum hernia repair score of 24 was possible (Appendix).

Data analysis

Coded data were entered and stored in REDCap. REDCap electronic data capture tools is a secure, web-based application designed to support data capture for research studies.[11] Data analyses, including summary statistics, analysis of variance (ANOVA), and Pearson correlations, were performed using SPSS 23.[12] The goal of analysis was to compare differences in first time performance scores with second time (repeat) performance scores.