Volume and Supervision of Resident Procedures Logged After Implementation of a Procedure Medicine Curriculum

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INTRODUCTION

The American Board of Internal Medicine has not required competency in procedures such as paracentesis, central venous catheter (CVC) insertions, and lumbar punctures (LP), but graduating residents may be expected to perform these procedures independently after training.¹ Practicing internists and trainees report decreasing comfort in performing procedures and a decline in a number of procedures performed over time.^{2, 3} This presents a concerning decrease in experienced internists to perform, teach, and supervise procedures.^{4, 5} The Virginia Commonwealth University School of Medicine Internal Medicine (IM) residency program implemented a procedure medicine curriculum modeled after one by Lenchus et al.,⁶ including simulation-based training in CVC insertion, LP, and paracentesis and a rotation on a hospitalist-staffed procedure service. We assessed the impact on the volume of procedures logged by IM residents and the type of supervision provided.

METHODS

We performed an observational, retrospective analysis of procedures logged by IM residents in a residency data management system from 2013 to 2018. We extracted type of procedure, date performed, resident level of training, and supervisor status (resident, fellow, or faculty). The Institutional Review Board at Virginia Commonwealth University declared the study exempt.

Data Analysis

We summarized data using mean with standard deviation or median with interquartile range for continuous variables and frequencies or percentages for categorical variables. We compared pre-implementation (2013–2016) with post-implementation (2016–2018) data using Student's *t* test, Wilcoxon rank sum test, or chi-square test as appropriate. We used interrupted time-series analysis to compare time-trends of monthly logged procedures pre- and post-implementation. We used residual diagnostics to determine adequacy of fit

and the Durbin-Watson *d*-statistic and Breusch-Godfrey test for autocorrelation between the residuals. All analyses were performed in Stata for Windows 14.1 (College Station, TX).

RESULTS

Demographics

The average residency program size (112 vs. 115 residents, $p = 0.59$), average age (28.46 vs. 28.77, $p = .57$) and gender (51.4% vs. 55.7% male, $p = .58$) of entering residents, and the average number of residents logging procedures annually (78 vs. 81, $p = 0.14$) were not significantly different post-implementation.

Procedures Logged

The median number of monthly procedures logged by all residents increased significantly after implementation of the curriculum (45 vs. 63 procedures/month; $p < 0.001$). This increase was attributed to paracentesis (12 vs. 19 procedures/month, $p < 0.001$) and LPs (7 vs. 9 procedures/month; $p = 0.005$). There was both an immediate increase in the number of monthly procedures logged by 11.2 procedures (95% CI = -0.91 to 23.4 ; $p = 0.07$) and a continued increase at a rate of 1.1 procedures per month (95% CI = 0.25 to 1.88 ; $p = 0.01$).

Effect on Experience of Primary Operator of Procedures

The proportion of procedures logged by PGY1s decreased to 17% from 48.5% ($p < 0.001$) while those logged by PGY2s increased to 63.9% from 28.9% ($p < 0.001$). Post-implementation, the rate of increase in procedures logged per month was higher in PGY2s than PGY1s (difference = 1.35 procedures/month, 95% CI = 0.61 to 2.09 , $p < 0.001$) (Fig. 1).

Supervisor Characteristics

The proportion of attending supervisors increased from 14.8% to 54.2% of procedures logged ($p < 0.001$). The median number of procedures supervised by attendings increased (6 to 32 procedures/month; $p < 0.001$), while the median number of procedures supervised by residents decreased (21.5 to 7.5 procedures/month; $p < 0.001$). Attendings had a greater monthly rate of change in supervision (-0.04 vs. 0.71 procedure/month; $p < 0.001$) than residents or fellows (Fig. 2).

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Fig. 1 Training level of residents logging procedures. Open black dots represent procedures logged by PGY1s each month and black dotted line represents the rate of change in procedures logged per month by PGY1s. Solid black dots represent procedures logged by PGY2s each month and solid black line represents the rate of change in procedures logged per month by PGY2s. Solid gray dots represent procedures logged by PGY3s each month and dashed gray line represents the rate of change in procedures logged per month by PGY3s. Vertical dashed black line represents time point of implementation of the curriculum.

DISCUSSION

Procedures logged by residents trended upwards after implementing a standardized curriculum and upper-level residents logged a higher proportion of all procedures than interns post-implementation. Attending supervision of procedures

significantly increased while resident supervision of procedures significantly decreased. This retrospective analysis of data collected for educational and tracking purposes is limited to associations. We could not assess frequency of direct vs. indirect supervision, but know hospitalists directly supervised

Fig. 2 Training level of supervisor of logged procedures. Solid black dots represent procedures supervised by faculty attendings each month and solid black line represents the rate of change in procedures supervised per month by faculty. Open black dots represent procedures supervised by fellows each month and dotted black line represents the rate of change in procedures supervised per month by fellows. Solid gray dots represent procedures supervised by residents each month and solid gray line represents the rate of change in procedures supervised per month by residents. Vertical dashed black line represents time point of implementation of the curriculum.

procedures logged by residents on the procedure service post-implementation. We controlled for variation in logging behavior by analyzing periods when overall program curriculum and logging expectations were consistent.

Some procedures remain in the repertoire of internists, necessitating training that fosters an environment of safety for residents and patients alike. Our findings suggest a standardized curriculum with direct supervision by attendings provides opportunities for residents with standardized training to perform procedures with enhanced supervision and feedback.

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Authors: Rebecca Miller, MD¹; Adam Garber, MD¹; Harrison Smith, MD²; Manpreet Malik, MD³; Claire Kimberly, PhD¹; and Rehan Qayyum, MD, MSH¹

Affiliations: ¹School of Medicine Virginia Commonwealth University Health Systems, Richmond, VA, USA; ²Medical University of South Carolina, College of Medicine, Charleston, SC, USA; ³Emory University School of Medicine, Atlanta, GA, USA.

Corresponding Author: Rebecca Miller, MD; School of Medicine Virginia Commonwealth University Health Systems, Richmond, VA, USA (e-mail: Rebecca.Miller@VCUHealth.org).

Compliance with Ethical Standards:

Conflict of Interest: The authors declare that they do not have a conflict of interest.

REFERENCES

1. Abim.org. (2018). [online] Available at: <https://www.abim.org/~media/ABIM%20Public/Files/pdf/publications/certification-guides/policies-and-procedures.%20Accessed%2015%20Nov%202018> [Accessed 15 Nov. 2018].
2. Mourad M, Kohlwe J, Maselli J, Auerbach AD, MERN Group. Supervising the Supervisors—Procedural Training and Supervision in Internal Medicine Residency. *Journal of General Internal Medicine*. 2010;25(4):351–356. <https://doi.org/10.1007/s11606-009-1226-z>
3. Wigton RS, Alguire P. The Declining Number and Variety of Procedures Done by General Internists: A Resurvey of Members of the American College of Physicians. *Ann Intern Med*. 2007;146(5):355. <https://doi.org/10.7326/0003-4819-146-5-200703060-00007>
4. Sacks CA, Alba GA, Miloslavsky EM. The Evolution of Procedural Competency in Internal Medicine Training. *JAMA Intern Med*. 2017;177(12):1713–1714. <https://doi.org/10.1001/jamainternmed.2017.5014>
5. Barsuk JH, Cohen ER, Wayne DB, McGaghie WC, Yudkowsky R. A Comparison of Approaches for Mastery Learning Standard Setting. *Acad Med*. 2018;93(7):1079–1084. <https://doi.org/10.1097/ACM.0000000000002182>
6. Lenchus JD. End of the “see one, do one, teach one” era: the next generation of invasive bedside procedural instruction. *J Am Osteopath Assoc*. 2010;110(6):340–346.

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