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BRIEF CONTRIBUTION

Trends in emergency medicine resident procedural reporting over a 10-year period

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Abstract

Background: Procedural competency is expected of all emergency medicine (EM) residents upon graduation. The ACGME requires a minimum number of essential procedures to successfully complete training. However, data are limited on the actual number of procedures residents perform and prior studies are limited to single institutions over short time periods. This study sought to assess the number of Key Index Procedures completed during EM residency training and evaluate trends over time.

Methods: We conducted a retrospective review of graduating EM resident procedure logs across eight ACGME accredited residency programs over the last 10 years (2013–2022). Sites were selected to ensure diversity of program length, program type, and geography. All data from EM residents graduating in 2013–2022 were eligible for inclusion. Data from residents from combined training programs, those who did not complete their full training at that institution (i.e., transferred in/out), or those who did not have data available were excluded. We determined the list of procedures based upon the ACGME Key Index Procedures list. Sites obtained totals for each of the identified procedures for each resident upon graduation. We calculated the mean and 95% CI for each procedure.

Results: We collected data from a total of 914 residents, with 881 (96.4%) meeting inclusion criteria. The most common procedures were point-of-care ultrasound, adult medical resuscitation, adult trauma resuscitation, and intubation. The least frequent procedures included pericardiocentesis, cricothyroidotomy, cardiac pacing, vaginal delivery, and chest tubes. Most procedures were stable over time with the exception of lumbar punctures (decreased) and point-of-care ultrasound (increased).

Conclusions: In a national sample of EM programs, procedural numbers remained stable except for lumbar puncture and ultrasound. This information can inform residency training curricula and accreditation requirements.

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INTRODUCTION

Procedural competence is expected of all practicing emergency physicians.[1,2] In order to successfully complete residency training, emergency medicine (EM) residents must complete a minimum number of Key Index Procedures as determined by the Accreditation Council for Graduate Medical Education (ACGME), which have traditionally served as one factor for assessing procedural competency.[1] Program leadership is tasked with ensuring that trainees have adequate opportunities to meet these thresholds. However, there are limited data on EM procedural numbers, which can make it challenging for regulatory bodies to determine current procedural requirements and justify these requirements to training programs.

Prior research has sought to quantify the total number of procedures performed by EM residents but was limited by poor response rates, small sample sizes, and emphasis on a single point in time.[3–5] As individual training programs and environments can vary, it is important to include a broader range to account for these potential differences. Moreover, the practice of emergency medicine has changed over time with advances in medical knowledge and technology, which may influence the type, frequency, and performance technique of procedures. The impact of COVID-19 on procedural numbers and distribution is also important to ascertain.

Regulatory bodies and medical education leaders must continually reflect on the relevance and appropriateness of their accreditation requirements and training curricula to ensure that graduates are meeting desired outcomes and demands of society. Consequently, there is a need to better understand the current distribution of procedural and ultrasound numbers, as well as how these numbers have changed over recent years since procedure requirements were first determined. The objective of this study was to assess the number of Key Index Procedures reported during emergency medicine residency training and evaluate trends over time.

METHODS

Study design

We conducted a retrospective review of graduating EM resident procedure logs across eight ACGME accredited residency programs from 2013 to 2022. The institutional review boards at all eight sites reviewed the study and deemed it either exempt or approved without required consent.

Study population

All procedure data from categorical EM residents graduating in 2013 to 2022 were eligible for inclusion. Data from residents of combined training programs (e.g., EM and internal medicine/family practice/critical care), residents that did not complete their full training at that institution (i.e., transferred in/out of the program), or residents with missing data were excluded. The sites were intentionally selected to ensure a breadth of program lengths (3- vs 4-year), program type (academic, community, county), and geographic locations. The list of sites and program characteristics are included in the Appendix S1.

Study protocol

We determined the list of procedures based upon the ACGME list of Key Index Procedures.[1] Each site obtained anonymous, resident-specific totals for each procedure upon graduation, which in most instances was based upon resident self-report and did not differentiate actual versus simulated procedure. Data were entered into a standardized data collection spreadsheet by each site lead (Appendix S1).

TABLE 1 Distribution of procedural numbers per resident by year of graduation

Year of graduation	Point-of-Care ultrasound (mean, 95% CI)[a]	Adult medical resuscitation (mean, 95% CI)	Intubation (mean, 95% CI)	Adult trauma resuscitation (mean, 95% CI)	Central Venous Access (Mean, 95% CI)	Pediatric medical resuscitation (mean, 95% CI)
2013 (n = 78)	287 (230–344)	138 (93–183)	75 (67–82)	78 (63–93)	48 (42–54)	29 (22–35)
2014 (n = 81)	270 (201–338)	138 (110–166)	79 (72–86)	75 (64–86)	47 (43–51)	28 (23–32)
2015 (n = 87)	326 (267–384)	170 (106–234)	94 (84–103)	85 (72–97)	50 (46–55)	39 (28–49)
2016 (n = 81)	371 (327–414)	159 (118–199)	86 (79–93)	89 (73–105)	45 (41–50)	34 (26–42)
2017 (n = 88)	325 (287–363)	143 (121–165)	87 (80–94)	92 (79–106)	50 (43–56)	30 (26–35)
2018 (n = 88)	346 (304–389)	148 (120–175)	88 (80–96)	88 (75–102)	48 (44–53)	36 (31–42)
2019 (n = 77)	415 (372–458)	126 (105–147)	83 (76–90)	75 (65–86)	44 (40–48)	30 (26–34)
2020 (n = 89)	369 (331–406)	141 (122–160)	88 (83–94)	88 (76–100)	48 (43–52)	30 (26–34)
2021 (n = 107)	510 (445–575)	129 (104–153)	89 (83–94)	81 (69–93)	49 (45–53)	27 (24–30)
2022 (n = 105)	519 (444–594)	135 (113–158)	84 (79–90)	83 (72–95)	49 (45–54)	28 (25–32)
AVERAGE (n = 881)	386 (368–404)	142 (132–153)	85 (83–88)	84 (80–88)	48 (46–49)	31 (29–33)

Abbreviation: CI, confidence interval.

[a]Ultrasound data were not available for 85 residents.

Data analysis

The analyses were descriptive in nature. We calculated the mean and 95% confidence intervals for each procedure. Data were presented in a summative manner, as well as by year of graduation. All analyses were performed in Microsoft Excel 365 and Stata 16.

RESULTS

We collected data from 914 total residents across all eight programs, with data from 881 (96.4%) meeting inclusion criteria. Of the 33 residents excluded, 18 were due to missing data, 14 had transferred in or out, and one was a non-categorical resident. In addition, 85 residents (9.6%) were missing point-of-care ultrasound (POCUS) data only. There were 522 (59.3%) men, 358 women (40.6%), and one (0.1%) non-binary resident, which is similar to national data among EM residencies (60.6% men, 39.4% women).[6]

The mean number of total procedures and distribution per year are included in the Table 1. Adult resuscitations were significantly more frequent than pediatric resuscitations and medical resuscitations were more common than trauma ones. The least frequent procedures included pericardiocentesis, cricothyroidotomy, cardiac pacing, vaginal delivery, and chest tubes. Most procedures were relatively stable over time with the exception of lumbar punctures, which decreased, and POCUS, which substantially increased over the 10-year period (Appendix S1).

DISCUSSION

This study characterizes the frequency of ACGME Key Index Procedures and trends in these procedures over time using multi-institutional data from a broad range of training programs. These data provide important insights for educators and regulatory bodies to better understand not only how individual program statistics compare to this national sample, but also to help understand the degree of within-year and year-over-year variability in these statistics.

Overall, most procedures had similar rates at graduation across the 10-year study interval, which suggests a stable minimum level of experience for graduating residents. However, these data may represent a "floor" of procedural experience rather than a "ceiling," given that residents may be less likely to log procedures once they reach the minimum required for graduation by the ACGME.[1]

Notable exceptions to the pattern of stability were lumbar punctures, which showed a decreasing trend over time, and total POCUS, which showed an increasing trend over time. It is unclear from this study whether the rise in POCUS frequency at graduation is from increased clinical use, increased educational ultrasound numbers, or improved efficiencies of logging POCUS exams. Further study is warranted to better understand this trend, including whether increased clinical POCUS imaging is related to increased use of similar POCUS exams or a broadening of the types of POCUS exams used in the clinical environment. Regarding the decreasing number of lumbar punctures performed by graduating residents, factors may include advances in knowledge and adoption of clinical pathways that obviate the need for lumbar puncture in situations where they were previously performed (e.g., subarachnoid hemorrhage, febrile infants).[7,8]

Another pattern in these data is that procedures with the highest rates (e.g., adult medical and trauma resuscitations, POCUS) also tended to have the greatest separation between the ACGME minimum requirement and the number recorded for graduating residents. The inverse pattern was observed for the rarest procedures (e.g., cricothyroidotomy, pericardiocentesis, cardiac pacing). For these, the mean number per graduating resident tracked closely along the minimum ACGME requirement and showed minimal variation with 95% confidence intervals often spanning as little as one to two procedures. These patterns suggest that ACGME requirements may heavily influence resident experience of rare procedures, such that the minimal threshold may drive their learning experiences for these procedures. Given the uniformity of these rates and their clinical rarity, it is possible that these

Procedural sedation (mean, 95% CI)	Lumbar puncture (mean, 95% CI)	Pediatric trauma resuscitation (mean, 95% CI)	Dislocation reduction (mean, 95% CI)	Chest tubes (mean, 95% CI)	Vaginal delivery (mean, 95% CI)	Cardiac pacing (mean, 95% CI)	Cricothyroid-otomy (mean, 95% CI)	Pericardio-centesis (mean, 95% CI)
27 (24–31)	27 (24–30)	19 (16–23)	17 (15–19)	14 (12–16)	14 (12–15)	6 (5–7)	7 (6–8)	4 (3–4)
26 (23–28)	24 (22–26)	16 (14–18)	16 (14–18)	14 (12–15)	14 (13–16)	6 (6–7)	6 (5–7)	3 (3–4)
28 (25–31)	26 (23–28)	18 (16–20)	17 (16–19)	16 (15–17)	15 (14–17)	7 (6–8)	7 (6–8)	4 (3–4)
28 (25–31)	22 (20–24)	18 (15–20)	16 (14–17)	16 (14–18)	15 (13–16)	6 (5–7)	6 (5–7)	3 (3–4)
30 (27–33)	25 (22–28)	21 (17–24)	20 (16–23)	19 (16–22)	14 (13–16)	8 (6–11)	7 (6–9)	4 (4–5)
30 (26–33)	24 (22–26)	19 (16–21)	18 (16–21)	17 (16–19)	15 (13–16)	8 (7–9)	8 (6–9)	5 (4–5)
30 (26–33)	23 (21–25)	17 (15–19)	17 (15–19)	15 (14–17)	14 (13–15)	7 (6–8)	5 (5–6)	5 (4–5)
30 (26–34)	22 (20–24)	19 (17–21)	20 (17–22)	18 (16–21)	16 (15–17)	8 (7–8)	7 (6–9)	4 (4–5)
25 (23–27)	20 (18–21)	17 (15–18)	18 (16–20)	17 (15–18)	14 (13–14)	7 (6–7)	6 (6–7)	4 (4–5)
27 (24–30)	20 (18–21)	16 (15–18)	19 (17–21)	16 (15–17)	15 (14–16)	7 (6–8)	6 (5–6)	4 (4–4)
28 (27–29)	23 (22–24)	18 (17–19)	18 (17–19)	16 (16–17)	15 (14–15)	7 (7–7)	6 (6–7)	4 (4–4)

procedures may be taught near-exclusively using simulation, which may explain why the logged numbers parallel the ACGME requirements so closely. As our study was unable to separate clinically performed from simulation-based procedures, further research is needed to determine the distribution of simulated versus live procedures and whether each type should influence the minimum threshold number.

Finally, it is worth noting the potential impact of the COVID-19 on the procedural numbers and distribution. The first class to graduate after the initial COVID-19 surge in the United States (class of 2020) appears to have similar procedural rates as other graduating classes. This finding remained consistent for most applications through the subsequent two classes (2021 and 2022) with the exception of trends that were apparent before the pandemic (i.e., increasing POCUS and decreasing lumbar punctures). While prior work has demonstrated an impact of COVID-19 on the clinical exposure and experience,[9,10] it did not appear to impact the total procedural numbers for graduating residents. However, it remains unclear whether this was due to lack of an overall impact on numbers versus replacement of live patient procedures with simulated ones and future research is needed in this area.

LIMITATIONS

This study was limited to eight institutions. While we intentionally selected programs from different geographic locations and with varying program types, this may not fully reflect the distribution at other institutions. Data were also subject to resident self-report and the risk of under-reporting.[4] In addition, lack of clarity regarding the definition of medical and trauma resuscitations may result in variable reporting practices within and across programs. Future work involving the tracking of procedures using electronic health records and automated recording of procedures may be beneficial to increase the likelihood of capturing all procedural numbers. Moreover, the reporting software did not allow for the delineation of live patients versus simulated procedures. While simulated procedures are valuable for training (particularly high acuity, low frequency procedures), this may not reflect the same experience as performing the procedure in a live patient. Additionally, while this study assesses procedural numbers, it is important to note that this does not equate to procedural competency in isolation, which should also include directly observed assessment of skills.[11] Finally, this study included residents training during COVID-19, and it is possible that COVID-19 may have altered how procedural numbers were obtained.[9]

CONCLUSION

We described the mean number of procedures reported by EM residents and identified trends over a 10-year period. Rates of rare procedures closely aligned with graduation requirements, suggesting that ACGME minimums may importantly influence resident exposure to these procedures. Future work should examine this among other programs and reassess the ideal number needed and how best to determine competency for each application prior to graduation.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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