Differences in Emergency Medicine Resident Procedural Reporting by Gender in the United States

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ABSTRACT

Background Studies across specialties have demonstrated gender disparities in feedback, learner assessments, and operative cases. However, data are limited on differences in numbers of procedures among residents.

Objective To quantify the association between gender and the number of procedures reported among emergency medicine (EM) residents.

Methods We conducted a retrospective review of procedural differences by self-identified gender among graduating EM residents at 8 separate programs over a 10-year period (2013 to 2022). Sites were selected to ensure diversity of program length, program type, and geography. Residents from combined training programs, those who did not complete their full training at that institution, and those who did not have data available were excluded. We calculated the mean, SD, median, and IQR for each procedure by gender. We compared reported procedures by gender using linear regression, controlling for institution, and performed a sensitivity analysis excluding outlier residents with procedure totals >3 SD from the mean.

Results We collected data from 914 residents, with 880 (96.3%) meeting inclusion criteria. There were 358 (40.7%) women and 522 (59.3%) men. The most common procedures were point-of-care ultrasound, adult medical resuscitation, adult trauma resuscitation, and intubations. After adjusting for institutions, the number of dislocation reductions, chest tube insertions, and sedations were higher for men. The sensitivity analysis findings were stable except for central lines, which were also more common in men.

Conclusions In a national sample of EM programs, there were increased numbers of dislocation reductions, chest tube insertions, and sedations reported by men compared with women.

Introduction

Procedural competence is expected for all physicians in surgical or procedurally oriented specialties. The Accreditation Council for Graduate Medical Education (ACGME) requires residents to complete a minimum number of key index procedures (KIPs) prior to graduation.[1] While performing a certain number of procedures is insufficient to attain competency in isolation, it is important to have a sufficient number to gather experience and receive structured feedback to improve proficiency.[2]

Studies across specialties have identified gender disparities in learner assessment and feedback.[3-10] Some studies have also reported gender differences in surgical case volume,[11-15] while others found no difference.[16] Outside of the operating room setting, there are limited data on gender differences in resident procedural experiences. One study of internal medicine residents found that men received more procedural opportunities than women in the intensive care unit compared with no difference when on the procedural service.[17] However, the overall number of procedures were low, and most residents had limited time on these procedural-based rotations. It remains unclear whether gender disparities among procedures may be present in more procedurally heavy fields, such as emergency medicine (EM). For educational leaders to create a fair and equitable training environment, we must examine gender-based differences in procedural access in all relevant specialties.

We sought to explore how gender is associated with the number of procedures reported among EM residents.

Methods

This was a secondary analysis of a retrospective review of graduating resident procedure logs across 8 ACGME-accredited EM residency programs from 2013-2022.[18] All procedure data from categorical EM residents graduating in 2013-2022 were eligible

DOI: http://dx.doi.org/10.4300/JGME-D-23-00238.1

Editor's Note: The online supplementary data contains further data from the study.

for inclusion. Data from residents of joint training programs (eg, EM combined with internal medicine/family medicine/critical care), residents who did not complete their full training at that institution (eg, transferred in/out of the program), or who had missing data were excluded. A low number of nonbinary residents were identified in the study period. To minimize the likelihood of identifiability, these residents were excluded from analysis. The 8 study institutions were already engaged in existing research on procedures and intentionally selected from among those to ensure a breadth of program lengths (3- vs 4-year), program type (academic, community, county), and geographic locations (provided as online supplementary data).[18-20]

The list of procedures was based upon the ACGME list of KIPs.[1] Each site obtained resident-specific totals for each procedure at the time of graduation, which was primarily based on resident self-report. Gender was also collected based on resident self-report (ie, self-declaration, Electronic Residency Application Service [ERAS] profile).[21] Data were de-identified and entered into a standardized data collection spreadsheet by each site lead.

We calculated the mean, standard deviation (SD), median, and interquartile ranges for each procedure by gender. We compared reported procedures by gender using linear regression controlling for institution. A sensitivity analysis was performed excluding outlier residents with procedure totals >3 SD from the mean. A P value <.05 was considered statistically significant. Analyses were performed using Stata 16 (StataCorp, LLC). The institutional review boards at all 8 sites reviewed the study, determining it as either exempt or approved without required consent.

Results

We obtained data from 914 residents across all 8 programs. Thirty-four residents were excluded (18 due to missing data, 14 had incomplete training, one for being a noncategorical resident, and one self-identified as nonbinary). Out of 880 (96.3%) residents meeting inclusion criteria, 358 (40.7%) were women and

TABLE
Measures of Central Tendency in Procedural Frequency by Gender

Procedure	ACGME Requirement	Women		Men		Predicted Procedures for Men Compared to Women	*P* value[a]
		Median (IQR)	Mean (SD)	Median (IQR)	Mean (SD)	Regression Coefficient Controlled for Institution (95% CI)	
Point-of-care ultrasound	150	341 (229-469)	404 (295)	323 (210-464)	375 (242)	-1.2 (-39.9-37.6)	.95
Adult medical resuscitation	45	99 (68-167)	144 (159)	104 (65-161)	141 (160)	-3.9 (-16.1-8.3)	.53
Intubation	35	79 (62-100)	83 (30)	82 (66-103)	87 (35)	1.6 (-2.2-5.3)	.42
Adult trauma resuscitation	35	71 (44-102)	84 (62)	70 (45-101)	83 (61)	-.9 (-7.7-5.9)	.79
Central line	20	45 (31-57)	47 (23)	47 (31-60)	49 (23)	2.2 (-.1-4.4)	.06
Pediatric medical resuscitation	15	25 (17-36)	32 (30)	27 (18-33)	30 (24)	-.5 (-2.7-1.7)	.66
Sedation	15	24 (17-34)	28 (15)	25 (17-35)	28 (16)	2.2 (.4-3.9)	.02
Lumbar puncture	15	21 (16-29)	24 (11)	19 (16-27)	22 (10)	0 (-1.2-1.1)	.98
Pediatric trauma resuscitation	10	15 (11-21)	17 (11)	15 (11-22)	18 (12)	.9 (-.3-2.2)	.15
Dislocation reduction	10	15 (11-22)	18 (11)	16 (11-23)	18 (9)	2.5 (1.4-3.6)	<.01
Chest tube	10	15 (11-19)	16 (9)	15 (12-19)	17 (9)	1.5 (.4-2.5)	.01
Vaginal delivery	10	13 (11-18)	15 (5)	13 (11-16)	14 (6)	.3 (-.4-.9)	.40
Cardiac pacing	6	6 (6-8)	7 (6)	7 (6-8)	7 (3)	-.1 (-.7-.6)	.85
Cricothyrotomy	3	6 (4-8)	6 (5)	5 (4-8)	7 (5)	0 (-.5-.5)	.86
Pericardiocentesis	3	4 (3-5)	4 (2)	4 (3-5)	4 (2)	.1 (-2.2-2.3)	.96

[a] Linear regression.
Abbreviation: ACGME, Accreditation Council for Graduate Medical Education.

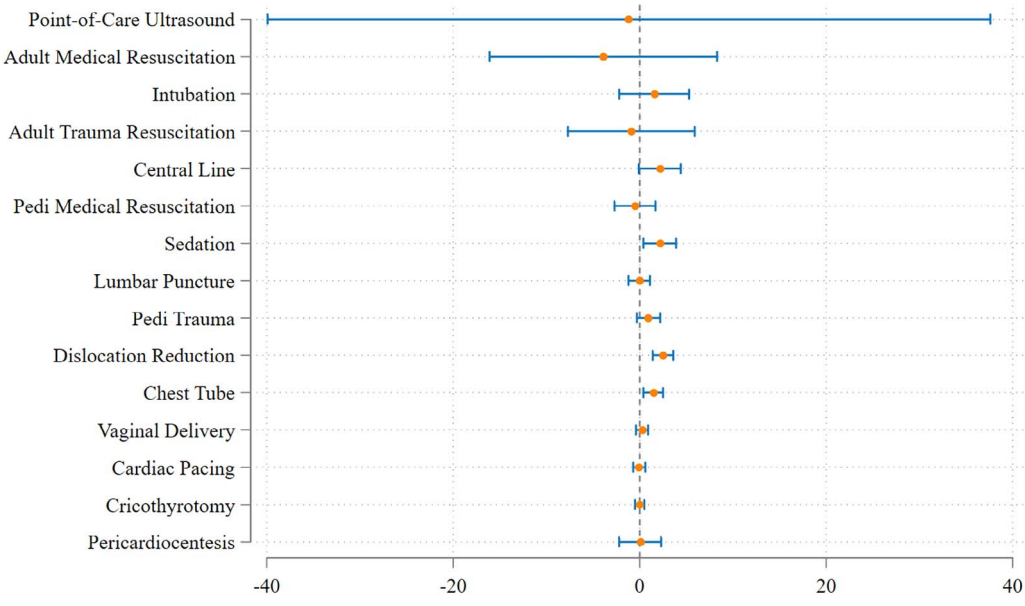

FIGURE
Difference in Predicted Procedures by Gender Adjusted

522 (59.3%) were men. Data were available for all residents for all procedures except point-of-care ultrasound, for which data were available for 795 residents (312 women, 483 men).

All mean, median, and interquartile ranges exceeded respective ACGME KIP minimum requirements (TABLE). In the unadjusted regression, dislocation reduction (regression coefficient 2.5; 95% CI 1.4-3.6; $P<.01$) and chest tube (regression coefficient 1.5; 95% CI 0.4-2.5; $P=.01$) numbers were higher for men compared to women (online supplementary data FIGURE 1). In the adjusted regression, sedation numbers were also higher for men (regression coefficient 2.2; 95% CI 0.4-3.9; $P=.02$; TABLE, FIGURE). The sensitivity analysis findings were stable except for central line numbers, which were also higher among men in this analysis (online supplementary data FIGURE 2).

Discussion

In this study of gender differences in reported procedures among EM residents, we identified modest differences across genders in 3 of 15 procedures. This is consistent with existing literature on surgical case volume, which demonstrated gender differences in some, although not all, studies.[11-15,22]

There are several factors that contribute to a resident's procedure numbers. Prior research has emphasized procedural aggressiveness, assertiveness, and confidence as factors influencing access to procedures.[17] These factors may be influenced by past feedback, autonomy, and procedural experiences. One study in the surgical environment found that women residents received less autonomy (particularly for complex cases) when compared with men residents.[22] In contrast, a recent study looking at implicit gender bias in assessment of procedural competency among EM residents did not detect any differences in scoring.[23]

The data on procedures outside the operating room are more limited. Interestingly, Olson et al reported gender differences in procedures performed in the intensive care unit, but not on procedural service, suggesting that the specific environment may also play a role in gender disparities.[17] Our study builds upon this by also demonstrating procedural disparities in emergency department (ED) environment. While most ED procedures did not demonstrate a gender bias, there were differences in the numbers for several: dislocation reductions, chest tube insertions, and sedations. This is particularly problematic given the limited number of dislocation reductions and chest tube insertions performed during residency.[18] Since both of these may require sedation, it is possible that the rate of sedations may have followed these disparities.

Data were limited to 8 institutions. While we intentionally selected a broad range of programs with variable geographics locations, program type, and length, this may not fully reflect the distribution at other institutions. Data were also limited by self-report, and we were not able to separate out simulated procedures. It is likely that these data underrepresent the total number of procedures performed, as residents may not diligently capture all procedures once minimum standards are met. Moreover, our data were limited to men and women residents, with

insufficient data to analyze differences among nonbinary residents without risking identifiability. While we utilized ERAS data for self-reported gender, this does not reflect the full spectrum of gender options.[21] These data may also have been affected by residents with significant moonlighting, clinical elective, or simulation lab time, which could have led to uneven distributions of procedural opportunities.

Importantly, our study was not able to assess the procedural experience itself. Procedures are complex, and the degree to which each was performed by the resident, as opposed to assisting with only some portions, is not clear. Prior work has demonstrated biases in autonomy during surgical procedures, and it is imperative that future work seek to further understand the procedural experience in greater detail to identify any potential biases and opportunities to improve equity.[22]

Conclusions

In a national sample of EM programs, there were increased numbers of dislocation reductions, chest tube insertions, and sedations reported by men compared with women residents.

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Funding: The authors report no external funding source for this study.

Conflict of interest: The authors declare they have no competing interests.

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Received April 3, 2023; revisions received July 17, 2023, and October 16, 2023; accepted October 17, 2023.