Distribution of Clinical Rotations Among Emergency Medicine Residency Programs in the United States

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ABSTRACT

Introduction: There are over 200 emergency medicine (EM) residency programs in the United States. While there are basic criteria defined by the Accreditation Council for Graduate Medical Education (ACGME), there can be significant variation between programs with regard to rotation distribution. Therefore, it would be valuable to have a benchmark for programs to understand their rotation mix in the context of the national landscape. This study aimed to provide a breakdown of the length and percentage of EM residency programs with each clinical rotation in the United States. This study also sought to examine trends and changes in EM residency programs since 1986.

Methods: A list of all current EM residency programs was obtained using the ACGME website. All program websites were reviewed, and data were independently dual extracted by two investigators with discrepancies resolved by consensus with a third investigator. Programs without curricular data available online were queried via e-mail for the data. Programs were separated into 3- versus 4-year lengths. Mean, standard deviation, and range were calculated for each rotation.

Results: A total of 200 of 202 programs (99%) had data available. Of these programs, 84.5% had a dedicated pediatric EM rotation with mean length of 9.7 weeks among 3-year programs and 12.1 weeks among 4-year programs. A total of 88% had a dedicated ultrasound rotation, 60% had a dedicated toxicology rotation, 73.5% had a dedicated emergency medical services rotation, 74% had a dedicated orthopedics rotation, 60% had a dedicated administration rotation, 29% had a dedicated research rotation, and 95% had dedicated elective time.

Discussion: This study provides summative data regarding the rotation distribution among EM programs in the United States. Compared with prior data, there is less time dedicated to internal medicine rotations and increased pediatric, trauma, ultrasound, toxicology, and critical care experiences. These data will inform current and new EM residency programs when determining rotation selection.

Emergency medicine (EM) is a specialty requiring a broad range of knowledge and skills. As such, EM residents must gain expertise in a wide range of topics.¹ This is typically obtained through a combination of didactic training and clinical rotations.

Guidelines for EM residency curriculum development are based upon those set forth by the

American Board of Emergency Medicine¹ and the Accreditation Council on Graduate Medical Education (ACGME).² The ACGME has specific requirements that include a minimum of 4 months of dedicated critical care experience and 5 months of dedicated pediatric experience, although this latter aspect may be substituted with emergency

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department (ED) rotations with at least a 20% pediatric volume.²

However, the actual distribution of rotations beyond the minimum criteria may vary significantly between programs. This heterogeneity between programs may lead to different experiences for graduates.³ With expansion of programs and increasing focus on efficiency in training,^{4–6} it is important to understand the current distribution of rotational components among EM programs. To our knowledge, the last study evaluating rotation distributions was performed in 1986.⁷ However, there are no more recent data describing the overall rotation breakdowns among EM residency programs and there have been significant changes in the number and structure of EM residency programs since that time. Therefore, this study sought to provide a descriptive analysis of the length and distribution of the rotations among EM residency programs in the United States and to examine trends and changes since 1986.

METHODS

A list was compiled on August 30, 2017, of all EM residency programs accredited by the Accreditation Council for Graduate Medical Education (ACGME; <https://apps.acgme.org/ads/Public/Reports/Report/1>). A data extraction tool was developed to identify and categorize program-level data. The tool was piloted independently by three investigators and modified in accordance with the pilot data. Two investigators were then trained on the use of the tool and performed a second pilot of 10 programs to determine initial precision before beginning the study.

On September 14, 2017, two investigators independently obtained the following data using publicly accessible residency recruitment websites: program name, location, program length, primary type of residency (i.e., allopathic or osteopathic), total number of residents, total number of program directors and assistant/associate program directors, specific fellowships, and number of weeks for each rotation type for each residency year (see Data Supplement S1, available as supporting information in the online version of this paper, which is available at <http://online.library.wiley.com/doi/10.1002/aet2.10117/full>). Any discrepancies between data were resolved by consensus with a third investigator. When data were not available via the residency website, the program director, assistant program directors, chairperson, and

program administrator were contacted a minimum of three times via e-mail.

Programs were separated into 3- vs 4-year lengths. Mean, standard deviation (SD), and range were calculated for each rotation and percent agreement was determined for extraction. Statistical analysis was performed with Microsoft Excel, version 16.1, and SPSS Version 25. This study was considered exempt by the Rush University Medical Center Institutional Review Board.

RESULTS

A total of 202 EM residency programs were identified through the ACGME list. Of these, 189 programs (93.6%) had their curricular information online. An additional 11 programs (5.4%) provided curricular information via e-mail. Two programs (1%) were unable to be evaluated because their information was not available online or via e-mail. Among the total extracted data, there were 24 discordant values of 18,715 potential values (99.9% agreement).

Table 1 includes the overall demographics of the included programs. Table 2 provides a breakdown of the percentage of programs with each of the specific rotation and the mean length of the rotations for 3- and 4-year EM residency programs.

Among 3-year programs, residents spent 83.6% of their total EM rotations at their home institution, while external rotations comprised 16.4%. Among 4-year rotations, residents spent 80.8% of their total EM rotations at their home institution, while external rotations comprised 19.2%. A total of 169 programs (84.5%) of programs had a dedicated pediatric EM rotation with a mean length of 9.7 weeks among 3-year programs and 12.1 weeks among 4-year programs.

The mean number of weeks dedicated to critical care rotations was 16.4 weeks for 3-year programs and 18.1 weeks for 4-year programs. Among the total ICU rotation time in 3-year programs, medical intensive

Table 1
Demographics of Included Programs

Total number of 3-year programs	150
Total number of 4-year programs	50
Number of residents per program, mean ($\pm$ SD)	36 ($\pm$ 13)
Number of residents per program, range	8–84
Total number of PDs and APDs per program, mean ($\pm$ SD)	3 ($\pm$ 1)
Total number of PDs and APDs per program, range	1–7

APD = assistant or associate program director; PD = program directors; SD = standard deviation.

Table 2
Distribution and Length of Rotations Among 3- and 4-Year Residency Programs

Rotation	3-Year Programs			4-Year Programs		
	% of Programs With This Rotation (150 Total Programs)	Duration (Weeks), Mean ($\pm$ SD)*	Duration (Weeks), Range*	% of Schools With This Rotation (50 Total Programs)	Duration (Weeks), Mean ($\pm$ SD)*	Duration (Weeks), Range*
Orientation	57% (85)	3.9 (1.5)	2–12	58% (29)	3.3 (1.0)	1–4
EM (home institution)	100% (150)	76.2 (17.1)	16–112	100% (50)	93.4 (24.5)	42–128
EM (away rotation)	59% (88)	14.9 (13.9)	2–80	58% (29)	22.2 (18.9)	2–62
Internal medicine	23% (35)	4.2 (0.9)	2–8	66% (33)	4.8 (1.9)	2–12
Medical ICU	98% (147)	7.6 (3.4)	2–20	98% (49)	8.7 (3.8)	4–16
Cardiac ICU	42% (63)	4.4 (3.4)	2–30	60% (30)	4.2 (1.2)	2–8
Surgical ICU	57% (86)	4.5 (2.1)	2–17	46% (23)	5.1 (1.9)	2–8
Neuroscience ICU	21% (31)	3.7 (1.1)	2–8	76% (38)	3.4 (0.9)	2–4
Pediatric ICU	85% (128)	4.0 (0.9)	2–8	76% (38)	3.9 (1.3)	1.75–8
Neonatal ICU	20% (30)	2.6 (0.9)	2–4	26% (13)	3.0 (1.2)	1–4
Anesthesia	91% (137)	3.0 (1.2)	1–6	95% (47)	3.2 (1.5)	1–8
Orthopedics	71% (107)	3.4 (1.3)	1–8	82% (41)	3.6 (1.5)	1–8
Trauma/burn	91% (137)	7.4 (3.9)	2–28	90% (45)	7.5 (4.7)	2–28
Ultrasound	89% (133)	2.7 (1.2)	1–8	86% (43)	3.1 (1.3)	1.3–6
OB/GYN	98% (147)	3.2 (0.9)	1–4	94% (47)	3.2 (1.2)	1–6
Pediatric EM	83% (125)	9.7 (5.0)	2–27	88% (44)	12.1 (5.9)	2–32
Toxicology	53% (80)	3.2 (1.3)	1–8	80% (40)	3.3 (1.0)	1–4
EMS	69% (104)	2.6 (1.1)	1–8	86% (43)	2.7 (1.2)	1–6
Administration	53% (80)	2.4 (1.0)	1–4	70% (40)	2.7 (1.2)	1–5
Research	27% (40)	3.1 (1.7)	1–7	36% (18)	3.7 (2.5)	1–8
Elective	95% (143)	6.7 (2.8)	2–16	94% (47)	13.1 (5.3)	4–26
Vacation	75% (112)	11.3 (1.5)	4–16	70% (35)	15.2 (2.0)	8–20
Other	70% (105)	6.4 (4.4)	1–20	92% (46)	11.8 (7.6)	2–30

EM = emergency medicine; EMS = emergency medical services; ICU = intensive care unit; OB/GYN = obstetrics and gynecology; SD = standard deviation.

*Among programs that have this rotation.

care unit (ICU) represented 45.1%, cardiac ICU 11.0%, surgical ICU 15.0%, neuroscience ICU 4.3%, pediatric ICU 20.7%, and neonatal ICU 3.0%. Among the total ICU rotation time in 4-year programs, medical ICU represented 47.7%, cardiac ICU 14.6%, surgical ICU 12.9%, neuroscience ICU 3.5%, pediatric ICU 16.9%, and neonatal ICU 4.3%.

Twenty-four programs (12%) did not have a dedicated ultrasound rotation. Among those with a dedicated ultrasound rotation, the mean length of time was 2.7 weeks among 3-year programs and 3.1 weeks among 4-year programs. Eighty programs (40%) did not have a dedicated toxicology rotation. Among those with a dedicated toxicology rotation, the mean length of time was 3.2 weeks among 3-year programs and 3.3 weeks among 4-year programs. Fifty-three programs (26.5%) did not have a dedicated emergency medical services (EMS) rotation. Among those with a dedicated EMS rotation, the mean length of time was 2.6 weeks among 3-year programs and 2.7 weeks among 4-year programs. Fifty-two

programs (26%) did not have a dedicated orthopedics rotation. Among those with a dedicated orthopedics rotation, the mean length of time was 3.4 weeks among 3-year programs and 3.6 weeks among 4-year programs.

A total of 114 programs (57%) described a dedicated orientation block. Among those with a dedicated orientation block, the mean length of time was 1.5 weeks among 3-year programs and 1.0 among 4-year programs. A total of 115 programs (57.5%) described a dedicated administration rotation. Fifty-eight programs (29%) described a dedicated research rotation. A total of 190 programs (95%) described elective time, with a mean length of 6.7 weeks among 3-year programs and 13.1 weeks among 4-year programs.

DISCUSSION

This study provides an outline of the current structure of EM residency program rotation schedules in the

United States. This can be a valuable resource for both new and established programs in an effort to understand current trends and how each program compares with respect to national averages. Newer EM residency programs may find this resource useful as a guide for creating their initial rotation plan by allowing them to align more with the structure of existing EM programs. Additionally, established program can compare their current structure with the national data to identify potential educational deficiencies.

The only prior study to evaluate overall rotation structures was published by Sloan and colleagues in 1988.⁷ This study surveyed EM residency programs for the 1986 academic year. At that time, only 66 programs were surveyed, whereas our current study evaluated three times the number of programs. Moreover, many of the included programs in the prior study had external internships, which are no longer present as part of EM residency programs. In addition to changes in the number and overall structure of EM programs, there have also been significant changes in both the growth of EM as a specialty and the accreditation standards.^{1,2}

Compared with the prior data, there is significantly less time spent on general medicine and general surgical rotations. In 1986, 74% of programs had an internal medicine requirement with a mean length of 10.35 weeks.⁷ Our data found that only 23% of 3-year programs and 66% of 4-year programs had an internal medicine requirement with overall mean lengths of 4.2 and 4.8 weeks, respectively. This change may be due to increased focus on more EM-relevant rotations with decreasing reliance on more general rotations, such as internal medicine, or the evolution of training as the specialty has grown over the past 30 years.

Conversely, we noted a significant increase in the amount of dedicated pediatric experience. Sloan and colleagues had found that only 65% of programs had dedicated pediatric EM rotations with a mean length of 7.6 weeks.⁷ In 1997, Tamariz and colleagues⁸ surveyed 111 EM programs regarding pediatric training and found that 85% of EM programs had dedicated pediatric EM rotations with a mean duration of 12 weeks. We found that 83% of 3-year and 88% of 4-year programs had a dedicated pediatric EM rotation with a mean length of 9.7 and 12.1 weeks, respectively. The increasing number of dedicated rotations likely reflects the increased recognition of the importance of pediatric training within EM, as well as the inclusion of pediatric EM training as an ACGME

requirement.^{2,8} However, it is likely that the pediatric experience is underrepresented in this study as many EDs include a combination of pediatric and adult patients, which would not be reflected in our study.

When compared with 1986, there was significantly more ICU experience in the current year. Sloan had found that only 38% of programs had critical care rotations and the mean length was 3.15 weeks.⁷ Our study found that 100% of both 3-year and 4-year rotations had critical care rotations with means of 16.4 and 18.1 weeks, respectively. This is likely due to increased recognition of the importance of critical care training in EM, as well as the inclusion of dedicated critical care rotations in the ACGME requirements.² While there are limited comparison data with regard to specific ICU rotations from the prior study, it is interesting that approximately half of all ICU experience was based in the medical ICU, while the remainder occurred in a range of subspecialty ICUs.

EMS remained relatively unchanged, with 67% of programs having a dedicated rotation in 1986,⁷ compared with 69% of 3-year programs and 86% of 4-year programs in this study. While toxicology and ultrasound were not common rotations in 1986,⁷ they have become significantly more common. Toxicology rotations were found in 53% of 3-year programs and 80% of 4-year programs, while dedicated ultrasound rotations were found in 89% of 3-year programs and 86% of 4-year programs. This is also an increase from a 2008 study by Ahern and colleagues,⁹ which found that only 72% of EM programs in the United States had a dedicated ultrasound rotation. As both fields have been increasingly integrated into the specialty of EM, it is not surprising that more time is dedicated to this for EM residents. Additionally, the proliferation of fellowships in both fields may also have contributed to this increase.

Interestingly, there was less elective time in the current block schedules compared with 1986. Sloan had found that 97% of EM programs had elective rotations with a mean length of 13.5 weeks.⁷ Our data found that 95% of 3-year programs and 94% of 4-year programs had elective rotations with a mean duration of 6.7 and 13.1 weeks, respectively. It is possible that the decrease in elective rotations is due to the inclusion of many previously defined electives (e.g., anesthesia, administration, research) into required rotations. Alternatively, there may be greater focus on increasing the numbers of EM rotations at the expense of elective time.

LIMITATIONS

Data for two programs were not available despite multiple attempts to contact the program leadership. However, this represents only 1% of the total programs and it is unlikely that this would significantly influence the current data. It is possible that the data may not reflect the most up-to-date rotation data and that actual rotation distributions may differ. However, most of the residency websites had up-to-date information on the residents and other program-level information, so it is unlikely that this was the only aspect not updated. Additionally, this study was conducted immediately prior to resident recruitment and it is likely that program websites would be the most accurate at this time given the importance of accurate data for recruitment. Moreover, some rotations did not fit into the predetermined categories, which may have underrepresented some proportions. Examples of “other” rotations included general neurology, cardiology, ophthalmology, and otolaryngology, among others. However, we utilized pilot testing to ensure that the data instrument was reliable, and it had 99.9% concordance with respect to included values. Additionally, the total “other” category comprised only 4% of the total rotation time for programs, suggesting that the influence of this is relatively small. This study is limited by its retrospective methodology and all inherent limitations with this approach. It is important to note that the current study identifies trends in the length of rotation blocks, but we are unable to comment on the effectiveness of these rotations. Despite similar lengths of time, it is possible that rotation experiences may differ vastly between programs. Therefore, program leadership should factor in the quality of the rotation in addition to the length of time to ensure the highest quality experience for their residents. Future studies should assess what is the ideal rotation length for each program, as well as how this may be influenced by 3- versus 4-year program lengths.

CONCLUSION

This study provides data on emergency medicine residency rotation curriculum trends in the United States. Compared with prior data, there is less time dedicated to internal medicine rotations and increased pediatric, trauma, ultrasound, toxicology, and critical care experiences. Knowledge of rotation distributions and trends could help inform current and future programs, as well as governing bodies about the current structure of emergency medicine

resident education. This may be valuable to existing programs by identifying variations in their program's structure and allowing them to modify their rotation schedule to address any educational deficiencies. This may also be valuable to programs who are applying for accreditation as this can serve as a guide for creating an initial rotation plan.

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Supporting Information

The following supporting information is available in the online version of this paper available at <http://onlinelibrary.wiley.com/doi/10.1002/aet2.10117/full>

Data Supplement S1. Residency characteristics.