

BRIEF REPORT

The Practice of Emergency Medicine

Emergency physician resource utilization varies by years of experience

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Abstract

Objectives: One of the most pivotal decisions an emergency physician (EP) makes is whether to admit or discharge a patient. The emergency department (ED) work-up leading to this decision involves several resource-intensive tests. Previous studies have demonstrated significant differences in EP resource utilization, measured by lab tests, advanced imaging (magnetic resonance imaging [MRI], computed tomography [CT], ultrasound), consultations, and propensity to admit a patient. However, how an EP's years of experience may impact their resource utilization and propensity to admit patients has not been well characterized. This study seeks to better understand how EPs' years of experience, post-residency, relates to their use of advanced imaging and patient disposition.

Methods: Ten years of ED visits were analyzed for this study from a single, academic tertiary care center in the urban Northeast United States. The primary outcomes were utilization of advanced imaging during the visit (CT, MRI, or formal ultrasound) and whether the patient was admitted. EP years of experience was categorized into 0–2 years, 3–5 years, 6–8 years, 9–11 years, and 12 or more years. Patient age, sex, Emergency Severity Index (ESI), and the attending EP's years of experience were collected. The relationship between EP years of experience and each outcome was assessed with a linear mixed model with a random effect for provider and patient age, sex, and ESI as covariates.

Results: A total of 460,937 visits seen by 65 EPs were included in the study. Over one-third (37.6%) of visits had an advanced imaging study ordered and nearly half (49.5%) resulted in admission. Compared to visits with EPs with 0–2 years of experience, visits with EPs with 3–5 or 6–8 years of experience had significantly lower odds of advanced imaging occurring. Visits seen by EPs with more than 2 years of experience had lower odds of admission than visits by EPs with 0–2 years of experience.

Conclusion: More junior EPs tend to order more advanced imaging studies and have a higher propensity to admit patients. This may be due to less comfort in decision-making

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without advanced imaging or a lower risk tolerance. Conversely, the additional clinical experience of the most senior EPs, with greater than 9 years of experience, likely impacts their resource utilization patterns such that their use of advanced imaging does not significantly differ from the most junior EPs.

KEYWORDS

administration, length of stay, operations, quality, resource utilization, safety

1 | INTRODUCTION

1.1 | Background

One of the most pivotal decisions an emergency physician (EP) makes is whether to admit or discharge a patient. The emergency department (ED) work-up leading to this disposition decision may involve several resource-intensive evaluations or be based entirely upon the EP's clinical judgement. The use of advanced imaging, specialist consultations, and ED observation status inherently increase the cost and length of stay of an ED visit.¹⁻⁴

1.2 | Importance

Length of stay has been shown to vary significantly from physician-to-physician, likely in part to differences in resource utilization.⁵ Several cost measures and ED length of stay are tracked by the Centers for Medicare and Medicaid Services (CMS) as metrics of throughput, quality, and patient satisfaction. Previous studies have demonstrated significant differences in EP resource utilization and propensity to admit a patient.⁶⁻¹³ However, how an EP's years of experiences may impact resource utilization and propensity to admit is not well understood.

1.3 | Goals of investigation

In this study, we seek to better understand how an EP's years of experience, as measured by years since residency completion, relates to their use of advanced imaging and patient disposition. We hypothesize that as EP's years of experience increases, their ordering patterns become less conservative (ie, ordering fewer advanced imaging tests and admitting fewer patients).

2 | METHODS

2.1 | Study and design setting

The data for this study were acquired from a single academic tertiary care hospital in the urban Northeastern United States with about 55,000 annual ED visits. More than 95% of ED encounters are initiated

by a resident physician and subsequently staffed with an attending physician. Visit-level information was abstracted from an operational quality assurance database, without individual patient identifiers or other protected health information, in accordance with Health Insurance Portability and Accountability Act Safe Harbor Criteria. The data abstractors were blinded to the study hypothesis. The study was granted a waiver of informed consent for the use of deidentified data obtained from our institutional review board.

2.2 | Measurements

All ED visits between the dates of July 1, 2011 and June 30, 2021 were extracted from the electronic health record (EHR) and included if the patient was ≥ 18 years old and the assigned physician had completed an emergency medicine residency. Figure 1 depicts the visit inclusion criteria. Visits were excluded if the disposition was deceased, eloped, left without being seen, left against medical advice, or had no assigned attending. Of the total 121 EPs in the study period, only EPs that had at least 500 total visits for 3 years, and at least 30 visits in each of the years, were included, resulting in 65 EPs being included for analysis. These exclusion thresholds were drawn from those of similar studies.^{12,13} We selected a 10-year data set because it represented the most complete data available over an extended period in a single EHR. Additionally, we anticipate that to observe changes in EP practice behavior we would need to analyze several years of data. For each visit, the patient age, declared sex, race/ethnicity, and Emergency Severity Index (ESI) were collected from the EHR. EP residency graduation date and gender were collected from existing hospital credentialing and publicly available licensing information.

Two primary outcomes were examined to quantify resource utilization: use of advanced imaging and patient admission to the hospital. For the purposes of this study, ED observation status was considered as a hospital admission. Advanced imaging utilization was defined as ordering a computed tomography, radiology department performed ultrasound, or magnetic resonance imaging. If an order was cancelled before a final result, it was not included in the analysis. The disposition status of admit or discharge was assigned based on the first disposition placed in the EHR and was attributed to the initial EP caring for the patient. The primary outcomes were utilization of advanced imaging during the visit (computed tomography, magnetic resonance

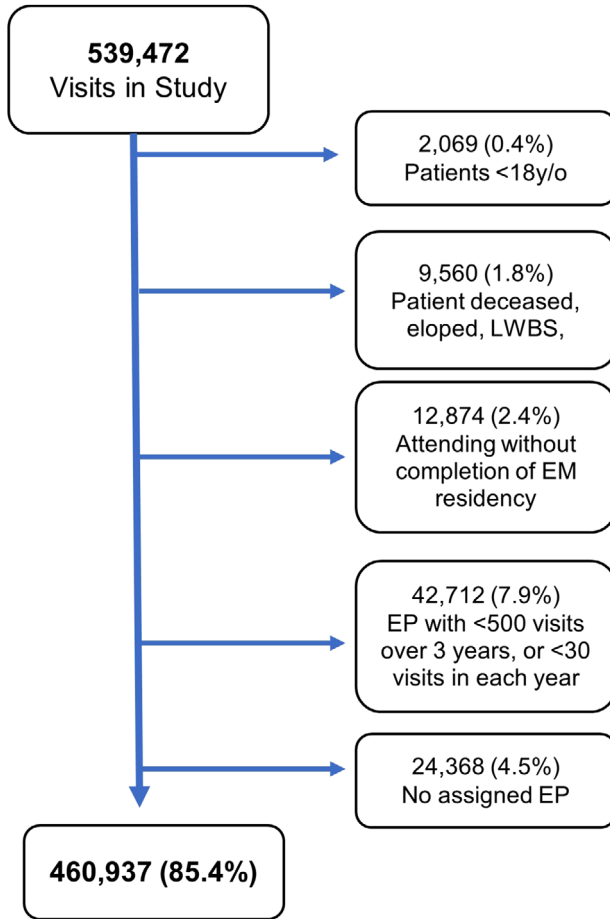


FIGURE 1 Flow diagram of visit inclusion statistics.

imaging, or radiology department performed ultrasound) and whether the patient was admitted or discharged.

EP years of experience was categorized into 0–2 years, 3–5 years, 6–8 years, 9–11 years, and 12 or more years post-residency training. Visit and patient characteristics were summarized and compared between the two levels for each outcome. Chi-square tests were used for categorical variables and *t*-tests were used for continuous variables for bivariate analyses. To measure the association of visit imaging and admission with EP years of experience, we fit a generalized linear mixed model for a binary outcome with random effects for individual EP, and adjusted for EP gender, visit date/time, ESI, and patient age, gender, and race. All analyses were performed in SAS v9.4.

3 | RESULTS

A total of 460,937 visits seen by 65 EPs were included in the study. Twenty (30.8%) of EPs were female. The average EP age at the time of a visit was 40.7 ± 8.1 years. The average EP years of experience at the time of a visit was 9.5 ± 7.0 years. Female EPs accounted for 27.2% of visits. Table 1 shows the number of visits by EP years of experience and describes the frequency of advanced imaging and admission by EP years of experience. Over one-third (37.6%) of visits had an advanced

The Bottom Line

Emergency physicians have enormous influence on health care costs, especially with respect to advanced imaging and hospital admission. Almost a half million visits to one urban academic emergency department (ED) showed that junior ED physicians within 2 years of residency had the highest utilization of advanced imaging and admission. This efficiency in resource utilization wanes after a decade of practice, suggesting that other factors other than just experience may be important.

TABLE 1 Resource utilization by emergency physicians (EPs) by years of experience at the time of visit.

EP years of experience	Number of visits (%)	Number with advanced imaging (%)	Number admitted (%)
0–2 years	81,475 (17.7)	31,002 (38.1)	40,505 (50.7)
3–5 years	98,821 (21.4)	37,073 (37.5)	48,043 (49.6)
6–8 years	58,756 (12.7)	21,693 (36.9)	28,537 (49.5)
9–11 years	43,099 (9.4)	15,313 (35.5)	20,577 (48.5)
12 or more years	178,786 (38.8)	68,159 (38.1)	86,352 (49.2)
Total	460,937 (100.0)	173,240 (37.6)	224,014 (49.5)

imaging study ordered and nearly half (49.5%) of visits resulted in admission.

In the multivariate model, EP years of experience was significantly associated with advanced imaging ($p = 0.0128$). The adjusted odds ratios for the categories of EP experience are presented in Figure 2. The reference group is 0–2 years. Visits seen by EPs with 3–5 years of experience had a 0.04 reduced odds of receiving advanced imaging (odds ratio [OR] = 0.96, confidence interval [CI]: 0.94, 0.98) compared to visits seen by physicians with 0–2 years of experience. Visits seen by physicians with 6–8 years of experience also had a reduced odds of imaging (OR = 0.96, CI = 0.93, 0.99).

In the multivariate model, EP years of experience was significantly associated with admission ($p = 0.0085$). The adjusted odds ratios for the categories of EP experience are presented in Figure 3. The reference group is 0–2 years. Visits seen by EPs with 3–5 years, 6–8 years, and >11 years of experience had a reduced odds of admission compared to visits seen by physicians with 0–2 years of experience.

4 | LIMITATIONS

The most notable limitation of this study is that it is a single center study at an academic, tertiary-care center. Furthermore, residents participate in the care of most visits and may initiate advanced imaging or

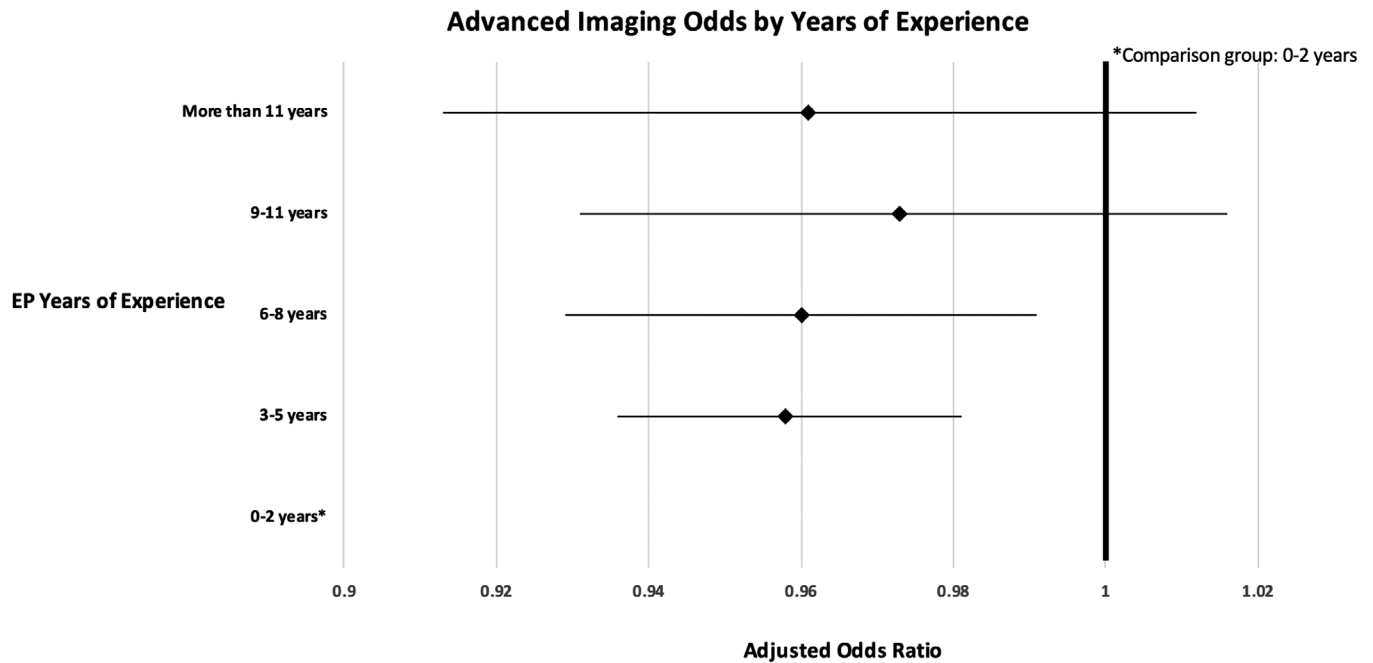


FIGURE 2 Adjusted odds ratio for the association between emergency physician years of experience and advanced imaging.

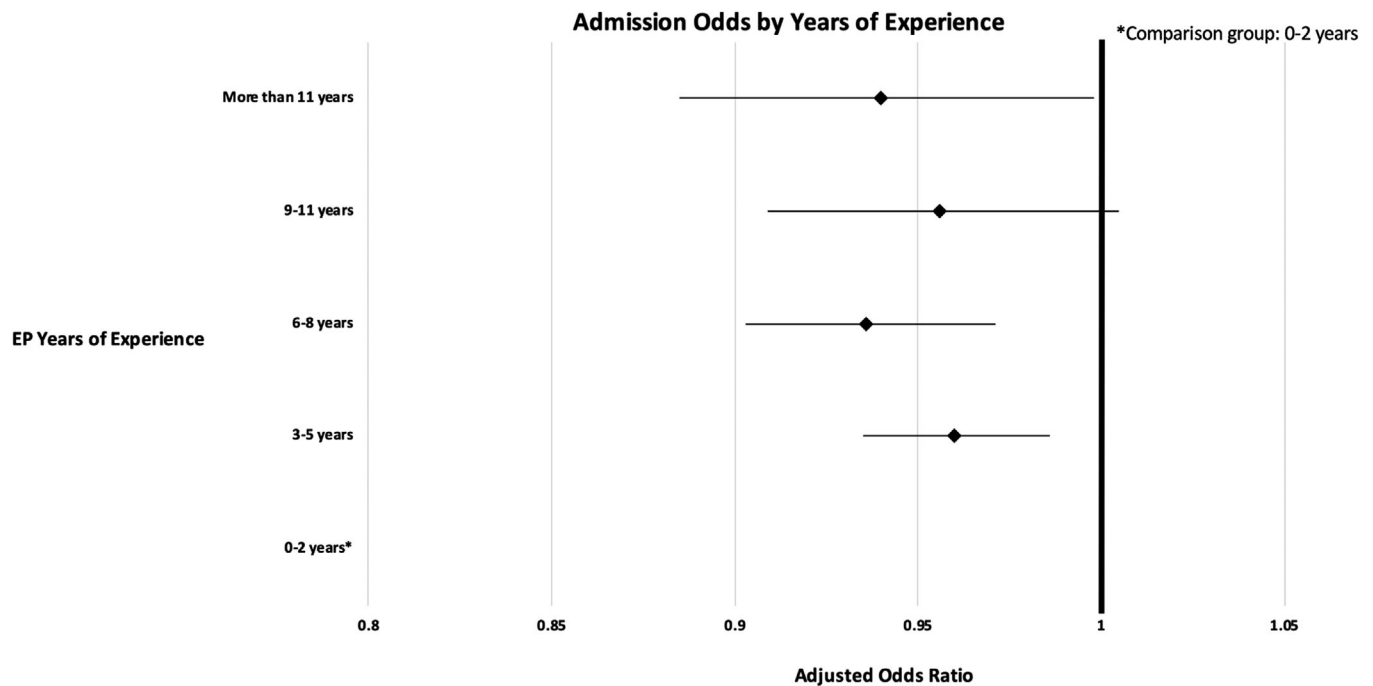


FIGURE 3 Adjusted odds ratio for the association between emergency physician years of experience and admission.

admission, though the attending physician at our institution is nearly always involved in this decision-making. All advanced imaging orders and admissions decisions were attributed to the first-assigned attending. Transfer of patient care to another attending EP (“sign-out”) does occur, though it is unusual for this to result in additional advanced imaging or change in disposition decision. We did not account for the shift type, daily volumes, bed availability, or physician sign-out. How-

ever, EPs at the institution do not have static schedules and tend to work equal amounts of all shift types (e.g., nights and weekends). Finally, the dataset did not distinguish between patients presenting directly to the ED versus arriving as a transfer from an outside ED for specialist consultation. In such cases, specialist consultations may have directed EP decisions regarding ordering advanced imaging and disposition decision.

5 | DISCUSSION

The results of this study demonstrate a significant association between EP years of experience and advanced imaging and admission. More junior EPs, based upon years since completion of residency, had a higher odds of ordering advanced imaging such as CT, MRI, and radiology performed ultrasound but not significantly more than EPs with 9 or more years of experience post-residency. The most junior EPs, less than 2 years post-residency, also had a significantly higher odds of admitting a patient when compared to more experienced physicians.

These findings may provide insights into EP resource utilization more broadly. It has been theorized that more junior EPs may utilize more resources in evaluating and dispositioning patients owing to fewer years of experience and less clinical certainty.¹³ Conversely, an abundance of experience and awareness of outlier cases in more senior EPs may lead them to behave more prudently.¹⁴ Contrary to both, it has been theorized that EP years of experience plays no role in resource utilization, and it is rather a function of individual risk tolerance or practice approach.^{12,15}

However, our findings suggest that an EP's resource utilization is associated with years of experience post-residency. The findings are partially consistent with both hypotheses regarding the relationship between years of experience and resource utilization. The most junior EPs tend to be the most circumspect in their clinical practice, with the greatest odds for advanced imaging and admission. The middle groups of 3–8 years of experience have significantly lower odds of imaging and admission when compared to the junior EPs, while the more senior EPs, with 9 or more years of experience, appear to return toward the more cautious practices of the junior physicians, with no significant difference in odds of advanced imaging and only marginally less odds of admission (Figures 2 and 3). This latter observation is contrary to our initial hypothesis that EPs with more experience would order fewer advanced imaging studies and admit fewer patients.

Notably, the confidence intervals widen with increasing years of experience, which suggests a wider range of individual EP imaging and admission practices. However, the overall trend of the most senior physicians to return toward more use of advanced imaging and greater propensity to admit might suggest that experience leads to increasing awareness of anomalous cases, less risk tolerance, or fear of malpractice.

The rates of admission and advanced imaging observed in these data were significantly higher than previously prescribed rates in community settings.¹⁶ This difference is likely due to the complexity of patients evaluated at the tertiary setting from which these data were abstracted. Admission rates observed were higher than previously described national averages of 38.9%, but similar to other hospitals in the Boston area.^{17,18} While this may limit generalizability of our findings, we would expect to see similar overall patterns of physician resource utilization in community settings and other geographic regions.

These findings have important implications for departmental leaders, hospital administrators, and national policymakers as they consider the delivery of cost-effective, high-quality emergency care. EP

practice variability has previously been identified as a target to reduce costs.^{7,8} However, given these findings demonstrating a correlation of resource utilization with years of experience, more studies are needed to evaluate the associated patient safety and quality outcomes. Higher resource utilization by more junior EPs may compensate for a less developed clinical gestalt, but result in similar high-quality outcomes to more experienced physicians. Additionally, perhaps the most experienced EPs have the most “optimal” resource utilization and admission practices that result in the best outcomes at the best cost. Additionally, while we observe a statistically significant effect, more research is needed to understand whether this small relative effect has clinical and operational implications.

The findings in this study suggest that the most junior EPs tend to order more advanced imaging studies and have the highest propensity to admit patients. Accordingly, EPs with 3–8 years of experience have a significantly lower odds of imaging and admitting patients compared to more junior physicians. However, this trend of resource utilization does not directly correlate with years of experience, as physicians with more than 9 years of experience appear to revert toward the more circumspect imaging and admissions practices of the most junior physicians. This study affirms that EP years of experience influences resource utilization.

More studies are needed to better understand whether small statistical differences across physician groups represent a clinically significant difference by evaluating how experience and resource utilization relate to cost, safety, and quality outcomes. Additional analyses are needed to better define appropriate resource utilization based on years of experience. How an EP's resource utilization may develop over time is important to understand as these findings may serve to provide valuable feedback to EPs so that they can achieve optimal resource utilization patterns throughout their career.

AUTHOR CONTRIBUTIONS

Peter S. Antkowiak and Nathan McDonald conceived the study. Ryan Burke performed the analysis. Nathan McDonald, Peter S. Antkowiak, Ryan Burke, and Bryan A. Stenson drafted the manuscript. All authors contributed substantially to its revision.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Partial datasets and data dictionary are available from date of publication upon request to Dr. David Chiu at dtchiu@bidmc.harvard.edu to investigators who provide an IRB letter of approval.

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