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Practice Readiness? Trends in Chief Resident Year Training Experience Across 13 Residency Programs

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Study Need and Importance: Urology residency must prepare trainees for independent practice. However, the optimal operative chief resident year experience to prepare for practice is undefined. We analyzed the temporal arc of cases residents complete during their residency compared to their chief year in a multi-institutional cohort.

What We Found: From a sample of 479 resident graduates, we found a total of 1,287,433 cases were logged, including 375,703 during the chief year (29%). Urologic oncology cases had the highest median percentage completed during chief year (56%) followed by reconstructive urology (27%), general urology (24%), endourology (17%), and pediatric urology (2%). Across the study period, all categories of cases had a downward trend in median percentage completed during chief year except for urologic oncology. However, only trends in general urology (slope of -0.68 , $P = 0.013$) and endourology (slope of -1.71 , $P \leq 0.001$) were significant (Figure).

Limitations: Our study is limited as the Accreditation Council for Graduate Medical Education case logs utilized are self-reported by residents. This can lead to errors in the accuracy of case logs and may lead to reporting bias.

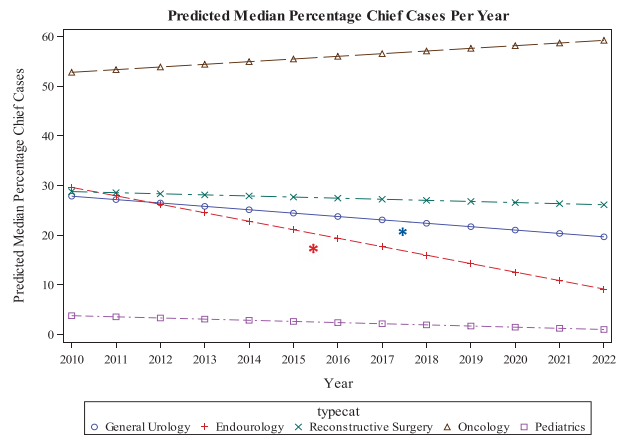



Figure. Percentage of cases completed during chief year. * indicates a significant change in median cases logged per year.

Interpretation for Patient Care: Our findings provide information that may aid residency training programs in their quest to optimally prepare trainees for independent practice.

Practice Readiness? Trends in Chief Resident Year Training Experience Across 13 Residency Programs

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Introduction: Urology residency prepares trainees for independent practice. The optimal operative chief resident year experience to prepare for practice is undefined. We analyzed the temporal arc of cases residents complete during their residency compared to their chief year in a multi-institutional cohort.

Methods: Accreditation Council for Graduate Medical Education case logs of graduating residents from 2010 to 2022 from participating urology residency programs were aggregated. Resident data for 5 categorized index procedures were recorded: (1) general urology, (2) endourology, (3) reconstructive urology, (4) urologic oncology, and (5) pediatric urology. Interactions were tested between the trends for total case exposure in residency training relative to the chief resident year.

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Ethics Statement: This study was deemed exempt from Institutional Review Board review.

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Results: From a sample of 479 resident graduates, a total of 1,287,433 total cases were logged, including 375,703 during the chief year (29%). Urologic oncology cases had the highest median percentage completed during chief year (56%) followed by reconstructive urology (27%), general urology (24%), endourology (17%), and pediatric urology (2%). Across the study period, all categories of cases had a downward trend in median percentage completed during chief year except for urologic oncology. However, only trends in general urology (slope of -0.68 , $P = .013$) and endourology (slope of -1.71 , $P \leq .001$) were significant.

Conclusions: Over 50% of cases completed by chief residents are urologic oncology procedures. Current declining trends indicate that residents are being exposed to proportionally fewer general urology and endourology cases during their chief year prior to entering independent practice.

Key Words: urology, resident education, Accreditation Council for Graduate Medical Education

Within the context of projected workforce shortages, producing competent graduating residents—prepared for independent practice—is crucial to meet growing patient needs.^{1,2} However, there is reported concern by both faculty and residents that surgical trainees across specialties are not being optimally prepared.¹⁻⁶ This concern may be attributed to duty hour restrictions, varying degrees of autonomy in the operating room, increased surgical procedure variety and complexity, and other program dependent variations.

While the Accreditation Council for Graduate Medical Education (ACGME) establishes minimum case requirements for urology residents, it does not prescribe a specific timeline for case exposure. Most programs structure residents' surgical exposure in a stepwise fashion (Figure 1) with periodic competency-based evaluation using the Urology Milestone Project.^{7,8} Junior residents (postgraduate year [PGY] 2 and PGY3) focus on learning minor procedures while senior residents (PGY4 and PGY5) manage the more complex cases. This, however, is only a general framework with potential for inter- and intra-program variability.

Research on publicly available ACGME urology case logs highlight that the number of index cases completed by urology residents continues to increase.⁹ Furthermore, the vast majority of residents surpass the minimum case requirements set by the ACGME.¹⁰ These minimums are in place to demonstrate whether a program has sufficient surgical volume to support resident training and are not intended to imply competence. Thus, simply meeting these case requirements alone may not be sufficient to optimally assess resident preparedness for practice as they complete the training experience.¹¹

The objective of this multi-institutional retrospective study was to characterize the case distribution that residents complete during their chief year compared to their entire residency. The goal of such analysis is to foster discussion on optimizing the surgical exposure schedule to maximize residency competency at graduation.

Methods

Study Design

This is a multi-institutional, retrospective analysis of de-identified ACGME case logs of graduating residents from 2010 to 2022. Twenty programs were invited to contribute case log data. Thirteen programs contributed. The included programs were selected from a geographically diverse range (East/West/North/South), program sizes, practice settings (rural vs urban vs suburban), and practice types.

Data Collection

ACGME case logs of graduating residents from 2010 to 2022 from participating urology residency programs were aggregated. ACGME case log data are self-reported by residents during residency training. Residents report their role in each case as either surgeon, assistant, or teaching surgeon, and the sum of roles is reported as “all roles.” ACGME data were reported according to specific case categories (eg, general urology, endourology/stone disease, reconstructive surgery, oncology, pediatrics) with various subcategories within each category.¹² ACGME case logs were drawn for individual resident's total residency and chief year.

ACGME data for 5 categorized index procedures were recorded: (1) general urology, (2) endourology, (3) reconstructive urology, (4) urologic oncology, and (5) pediatric urology. Resident case log data for all roles were collected for these 5 index procedure categories during chief year and total residency.

Data Analysis

Descriptive statistics were used to characterize trends across the study period for total residency and chief year case log data. The percentage of chief cases out of the total for each year and index procedure was calculated for each resident. Interactions were tested between the trends for total case exposure in residency training relative to the chief resident year. Because outcomes

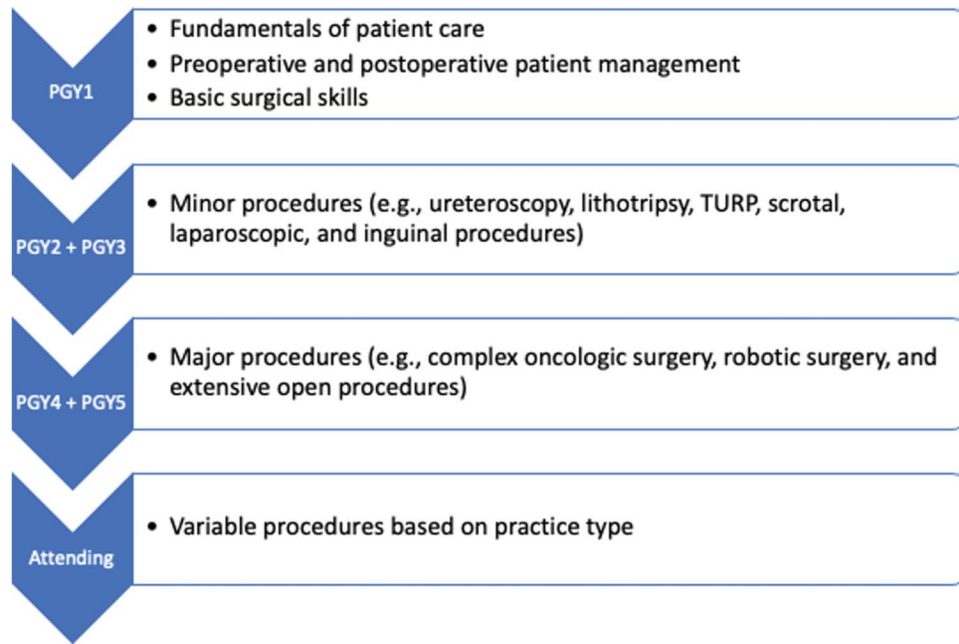


Figure 1. Stepwise progression of surgical case complexity during urology training. PGY indicates postgraduate year; TURP, transurethral resection of the prostate.

were not normally distributed, nonparametric methods that are based on medians were used. Data were analyzed using the Kruskal-wallis test to compare each index procedure. A quantile regression of the median for each index procedure was completed to analyze the change in index procedures. A comparison of the index procedures by institution was also completed with a Kruskal-Wallis test and pairwise Wilcoxon Rank Sum tests adjusted for multiple comparisons.

The primary outcome was the percentage of each categorized index procedure being completed during the chief year of residency. Secondary outcomes included the trends in individual index procedure to evaluate how resident cases have changed during the study period. P values $< .05$ were considered statistically significant. Statistical analysis was done using SAS version 9.4 (SAS Institute, Cary, North Carolina).

Results

Overall Case Logs

Case logs from 474 residents across 13 urology residency programs were included in the data set. A total of 1,287,433 total cases were logged, including 375,703 during the chief resident year (29%). On average, each resident completed a total of 2688 cases and 784 cases during their chief year.

Total Residency Case Log Trends

Figure 2, A depicts the yearly variation in the median of graduating residents' total residency case logs. General

urology had a median number of cases completed of 367 (range 0-968); endourology cases median 236 (range: 0-503); reconstructive urology cases median 156 (range: 0-705); urologic oncology median 259 (range: 0-750); and pediatric cases had a median of 189 total cases (0-583). Figure 2, B represents the trends in each index procedure during the study period. Endourology had a significant increase in case logs with a slope of 3.00 ($P = .045$). All other index procedure categories had a nonsignificant change in slopes. General urology, oncology, and pediatrics decreased in overall cases with slopes of -0.11 ($P = .95$), -0.33 ($P = .83$), and -1.20 ($P = .40$), respectively. Reconstructive urology increased in case logs with a slope of 1.57 ($P = .11$).

Aggregate Chief Year Case Log Trends

Figure 3, A depicts the yearly variation in the median of graduating residents' chief year case logs. Urologic oncology had the greatest median number of cases completed during chief year with 140 cases (range: 0-373). General urology followed with a median chief year case log of 81 cases (range: 0-124); then, reconstructive urology cases with a median of 44 (range: 0-155); endourology cases had a median of 34 (range: 0-275); and pediatrics had the lowest median with 4 cases during chief year (range: 0-176). During the study period, all index procedures had a downward trend in the median case logs during chief year (Figure 3, B). Endourology, reconstructive urology, and oncology had a significant decrease in case logs with

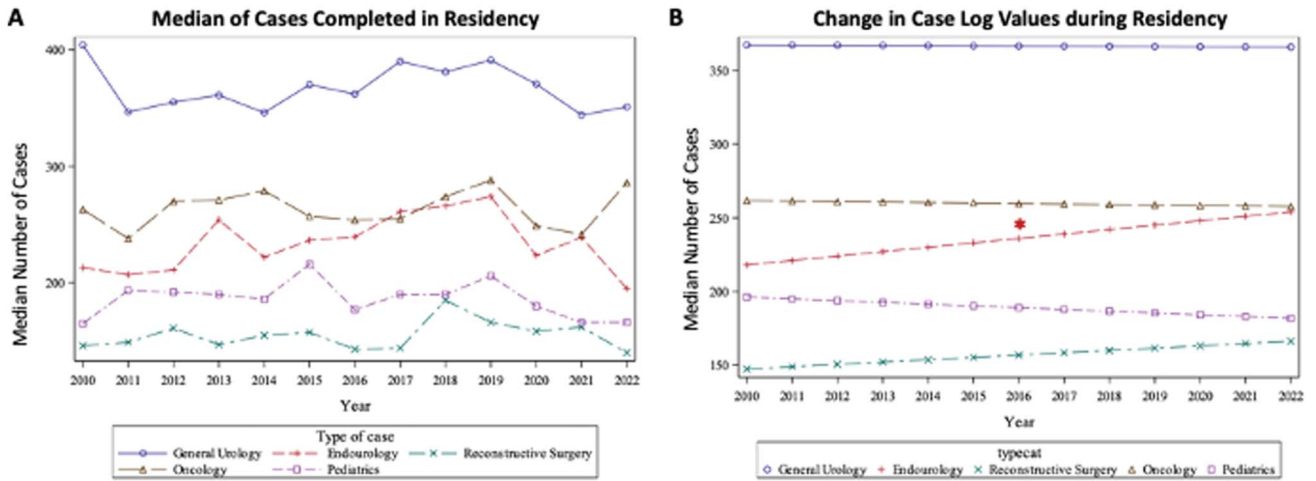


Figure 2. Variations in total residency case logs between 2010 and 2022. A, Plot of the median total of case types and year for graduating residents’ entire residency (postgraduate year 1 to postgraduate year 5). B, Change in the slope of case log values during the study period generated by a quantile regression of the median results. * indicates a significant change in median cases logged per year.

a slope of -1.80 ($P < .001$), -0.78 ($P = .03$), and -2.20 ($P < .001$), respectively. General urology (slope of -1.33 , $P = .06$) and pediatrics (slope of -0.33 , $P = .057$) had a nonsignificant decrease in cases logged during chief year during the study period.

Aggregate Comparison of Chief Year and Total Residency

Urologic oncology had the highest median percentage of cases completed during chief year (56%) followed by reconstructive urology (27%), general urology (24%), endourology (17%), and pediatric urology (2%). Across the study period, all categories of cases had a downward trend in median percentage completed during chief year except for

urologic oncology (Figure 4). However, only decreasing trends in general urology (slope of -0.68 , $P = .013$) and endourology (slope of -1.71 , $P \leq .001$) were significant. Reconstructive urology (slope of -0.22 , $P = .27$) and pediatrics (slope of -0.23 , $P = .09$) had a nonsignificant decrease in percentage of cases completed during chief year. Only urologic oncology (slope of 0.54 , $P = .14$) had a nonsignificant increase in percentage of cases completed during chief year.

Institutional Variability: Chief Year Analysis

The extent of variability of cases being completed during chief year was also analyzed among each of the 13

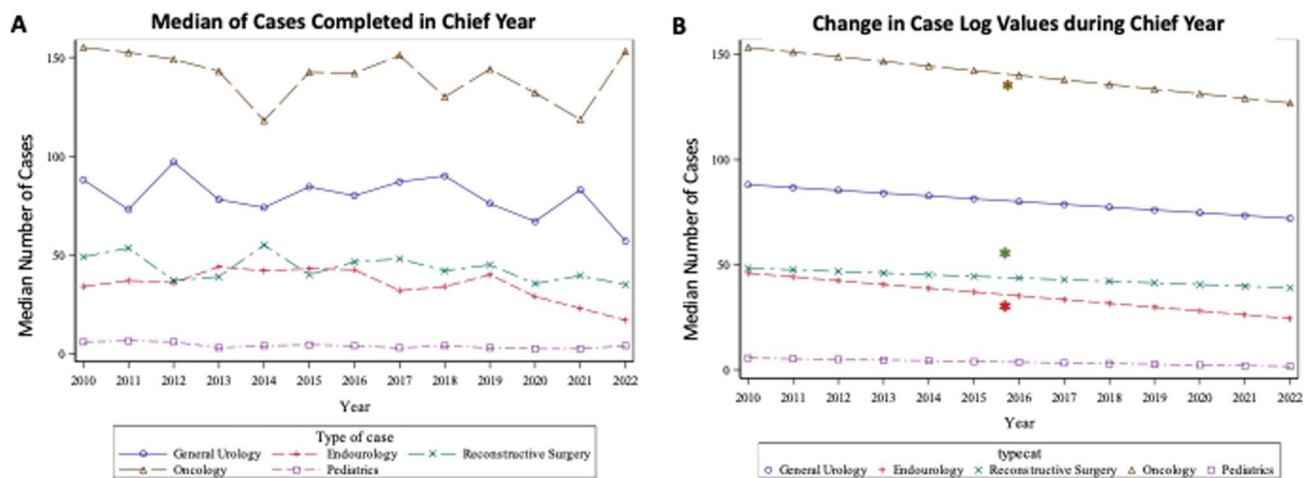


Figure 3. Variations in chief year case logs between 2010 and 2022. A, Plot of the median total of case type and year for graduating residents’ chief year. B, Change in the slope of case log values during the study period generated by a quantile regression of the median results. * indicates a significant change in median cases logged per year.

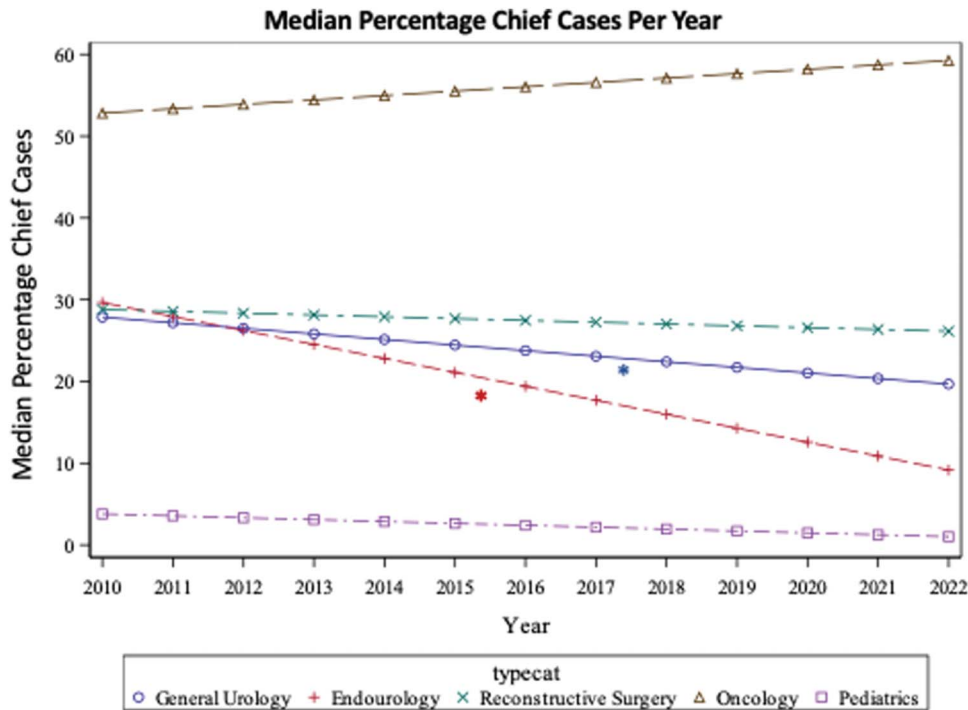


Figure 4. Percentage of cases completed during chief year. * indicates a significant change in median cases logged per year.

institutions. When comparing institutions, there was a significant degree of variability across the median predicted cases per year across different groups of index procedures (Figure 5, A to E).

Discussion

This multi-institutional, retrospective study describes the case distribution urology residents complete during their

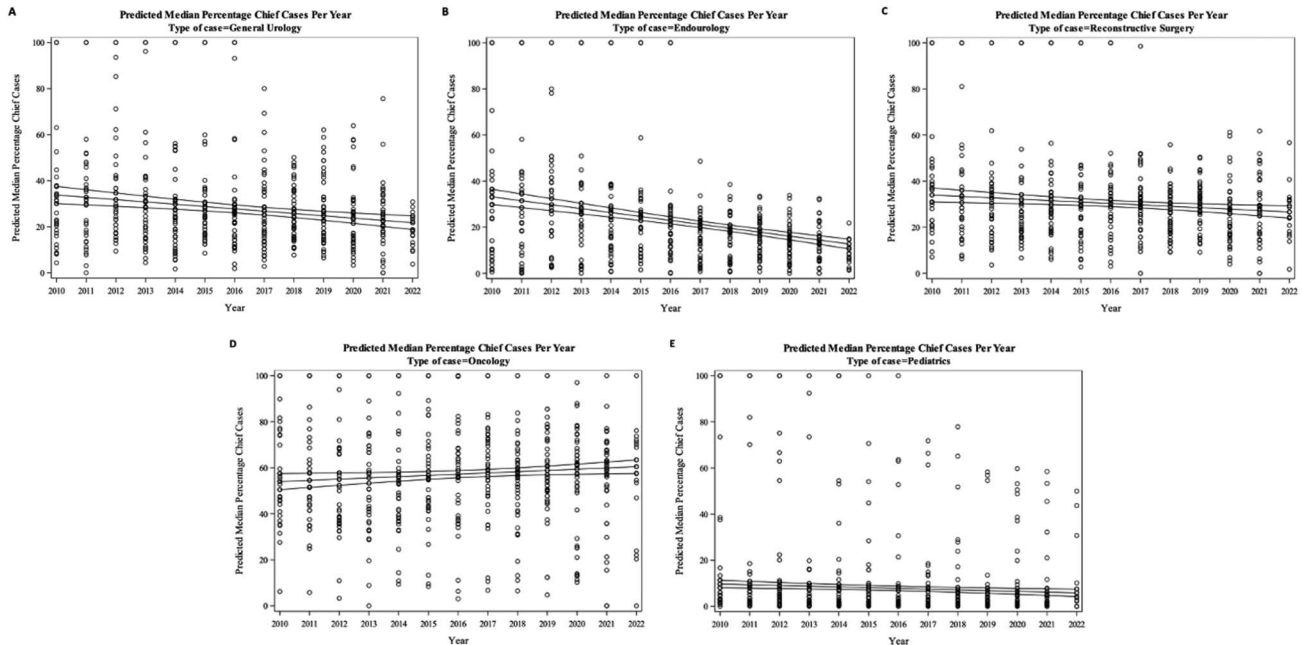


Figure 5. Institutional variability in chief year case logs. A, Plot of the median general urology cases per year among the 14 included urology programs. B, Plot of the median endourology cases per year among the 14 included urology programs. C, Plot of the median reconstructive urology cases per year among the 14 included urology programs. D, Plot of the median urologic oncology cases per year among the 14 included urology programs. E, Plot of the median pediatric urology cases per year among the 14 included urology programs. The middle line of graphs A to E represents the modeled median. The upper and lower lines represent the upper and lower confidence of the modeled median.

entire residency vs their chief year between the 2010 and 2022 academic years. Urologic oncology was the only index procedure with an increasing percentage of cases being completed during chief year over the study period. More than 50% of urologic oncology cases completed during residency were done during chief years. All other index procedures had a decreasing percentage of cases completed during chief year, with significant downward trends in general urology and endourology (Figure 4; $P = .013$ and $P < .0001$, respectively). It was also notable that there were significant variations in experience when considering case logs stratified by surgical domain (general urology, endourology, reconstructive urology, urologic oncology, and pediatric urology) between different institutions.

These trends may be reflective of surgical proficiency required to complete more complex cases. Cruz et al established a continuum of index urological procedures based on resident surgical volume and graduate proficiency. They categorized cases on a spectrum from low volume, low proficiency cases (eg, percutaneous nephrolithotomy, robotic prostatectomy) to high volume, high proficiency cases (eg, cystoscopy, transurethral resection of the prostate) based on the difficulty and case volume needed to attain proficiency for each index procedure.¹ Therefore, the trends in percentage of cases being completed during chief year may be a direct correlation to resident surgical proficiency. For instance, urologic oncology cases tend to require some of the highest level of surgical aptitude for residents to successfully complete. Therefore, it would make sense that the majority of urologic oncology cases logged are completed during the chief year of residency—when the trainee is most adept to handle a complex operation. Additionally, by chief year, residents would have completed enough of the high volume, high proficiency cases accounting for the decreasing trends seen in general urology and endourology cases. However, it remains unknown if this is truly the best way to prepare residents for independent practice. Most residents without a urologic oncology fellowship will not focus their practice on these complex urologic oncology procedures that were found to predominate their training during their final year of residency.¹³ We recognize, however, that surgical procedures are not the sole barometer for acquiring the competence of managing a disease in practice. Nonetheless, it may be more beneficial to structure a resident's surgical training to have a more individualized training plan during chief year, where the more complex cases are distributed more during their PGY3 and PGY4. Chief year of training then, may be best structured to provide residents with more dedicated time and mentorship to focus on attaining surgical proficiency in the index procedures they plan to build into their independent practice. As there continues to be growing variation in the operative experience and surgical proficiency of surgical trainees,^{14,15} a more individualized approach to chief

year surgical training intuitively appears best to prepare residents for independent practice. As a whole, surgical proficiency in residency training may be best assessed with a competency-based training model as discussed by Jaeger, Krumm, and Kraft. Case logging, especially for senior residents, may be primarily driven by meeting case minimums for graduation rather than actual skills building. A competency-based assessment of surgical training would allow room for chief residents to tailor their skills during chief year.¹⁶

During the past 12 years throughout a resident's training, there has been a significant increase in the number of endourology cases being completed over the course of residency training (Figure 2, B; $P = .45$) and a nonsignificant increase in reconstructive surgery, with nonsignificant downward trends in general urology, oncology, and pediatric urology cases. Further research is needed to understand the exact implications of these trends seen throughout a resident's training experience. Decreases in urologic oncology and pediatric urology cases may be a result of more of these cases being distributed to fellows.¹⁷ However, these trends may also be a direct result of individual resident interest or changes in the disease paradigm. Through the study period, residents consistently surpassed the ACGME set case minimum requirements. Thus, residents may have more flexibility in case selection after meeting their curricular requirements as seen in general surgery resident.¹⁸

All index procedure case volumes decreased during chief year with a significant decrease in endourology, reconstructive urology, and oncology cases (Figure 3, B; $P < .001$, $P = .03$, and $P < .001$, respectively). The decreasing trends in case volume during chief year were unsurprising given the general downward trends seen in a majority of index procedures throughout residency. This trend is concerning because a decrease in the case logs done during the final year of residency, despite the relatively stable total number of cases logged in residency (Figure 2), may be contributing to the concerning lack of surgical proficiency reported by trainees.¹⁻⁶ There are a multitude of factors that can be contributing to the decreasing trends including duty hour restrictions, an increasing level of administrative responsibility during chief year, or individual resident preference. As health systems expand, changes in care delivery models (eg, regionalization where residents don't cover cases at outlying sites) could be another contributing factor. It is also possible that urology fellows may be competing with residents for cases, or surgical advanced practice providers may be being used as first assists impacting the case log volume chief residents are able to obtain. There is also the chance that the expansion of residency programs, while allowing for residents to still obtain ACGME set case minimums, may be contributing to fewer cases for all residents. However, it remains unclear if the decrease in

case volume leads to decreased surgical proficiency upon graduation.

Our study is limited as ACGME case logs utilized are self-reported by residents. This can lead to errors in the accuracy case logs and may lead to reporting bias. These issues with reporting can explain the few case logs which had zero cases reported for study categories including general urology, endourology, and urologic oncology which would be unlikely to have had zero cases. The study period also includes residents whose chief years were impacted by the COVID-19 pandemic which may have had an impact on the cases completed during chief years for the academic year 2019 to 2020; however, the dataset used for analysis compared trends across the study period and includes the most representative evaluation. Additionally, throughout the study period, robotic surgery permeated into practice with significant residency exposure potentially contributing to a commiserate decline in robotic fellowships.

Despite the limitations, this study provides the first comparison of the case distribution that urology residents complete during their chief year compared to their entire residency from 2010 to 2022. Future studies may assess how the cases residents complete during their chief year compared to the case distribution they complete during their first few years of independent practice. Furthermore, the ramifications of these observations with respect to training paradigms in urology warrant consideration. Specifically, are the observations reflecting the natural progression of a trainee as they gain proficiency, or do they highlight a “top heavy” training model that may not align with eventual practice.

Conclusions

Over 50% of cases completed by chief residents are urologic oncology procedures. Current declining trends indicate that residents are being exposed to proportionally fewer general urology and endourology cases during their chief year. More research is needed to determine if lack of exposure to general urology and endourology during chief year translates into decreased preparedness for independent practice.

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Editorial Commentary

In this article, the authors present a descriptive analysis of trends in resident case logs over a 12-year period within different subspecialties of urology with a focus on the chief resident year and preparation for independent practice.¹ The focus of this work is important, as practice readiness is critical in urology training, yet both residents and attendings have low confidence in trainees' independence at the conclusion of residency.² As the authors aptly relay, meeting ACGME minimum case requirements is not necessarily a sufficient surrogate for practice readiness, and other—more meaningful—metrics may be needed.

The structure of each residency training program is unique, with variability among case exposure, case volume, timing, and level of independence across programs. This presents challenges to understand how to design an optimal training program that sets residents up for independent practice at the conclusion of residency. It may require that residency programs re-think longstanding structures and rotations in order to optimize resident training towards a focus on readiness. More data are needed to help guide these changes, including understanding the optimal exposure to and timing within various subspecialties as residents progress through training.

Some of the most important aspects of shaping residents' readiness for independent practice may lie in the role the resident plays during cases, whether they are involved in a case as an assistant, surgeon, or teaching surgeon. The autonomy that comes with residents having opportunities to serve as teaching surgeons may be more difficult to achieve in the current training culture, and future studies should evaluate this aspect of training to guide future residency rotation structure.

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