



Regular Article

Pathology education project (PEP): A pilot program to spark student understanding in pathology as a career

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A B S T R A C T

According to the National Resident Matching Program in 2022, 631 pathology positions were offered. In total, 248 senior applicants from United States (US) allopathic schools filled 36.6% of these positions. To bolster medical student understanding of pathology, a medical school pathology interest group organized a multi-day activity to introduce rising second-year medical students to pathology as a career. Five students completed both pre- and post-activity surveys assessing their knowledge of the specialty. All five students had a BA/BS degree as their highest level of education. Only one student indicated that he or she had previously shadowed a pathologist as a medical laboratory scientist for a duration of four years. Two students indicated that they were interested in internal medicine, one indicated radiology, one forensic pathology or radiology, and one was undecided. During the activity, students biopsied tissue from cadavers in the gross anatomy lab. Thereafter, students participated in the standard tissue processing by shadowing a histotechnologist. Under the guidance of a pathologist, students microscopically examined slides and discussed the clinical findings. Post-activity survey results indicated that participation increased their knowledge of pathology as a career with a median increase of 0.8 points (range: 0.2 to 1.6) on a 5-point Likert scale. Students also indicated that their participation increased their knowledge of pathology skills and techniques—median increase of 1.2 (range: 0.8 to 1.8). This activity can be implemented by medical educators to expose medical students to pathology as a career with the benefit of increasing student knowledge in the specialty.

Keywords: Pathology, Medical student, Specialty choice

Introduction

Since 2008, there has been an upward trend in the number of pathology residency positions offered (Fig. 1). However, there is a simultaneous downward trend in the number of allopathic medical degree (MD) applicants to pathology residency (Fig. 1). In 2022, there was a significant increase in allopathic MD seniors accepting pathology residency positions in comparison to the data collected from 2018 to 2021. A total of 248 allopathic MD seniors applied for 631 pathology residency positions offered and filled 36.6% of these positions. Although the number of graduate medical students applying and matching into pathology increased in 2022, pathology residency has the second lowest percentage of positions filled by allopathic MD seniors out of the 15 major medical specialties.^{1,2} Since 2008, there has been a 23.9% decrease in allopathic MD seniors applying for pathology residencies and a 22.5% decrease in allopathic MD seniors filling these positions. In contrast, the number of pathology residency positions offered has increased 24.2% over the past 14 years. Based on pathology workforce projections in 2015, the current number of all resident graduates, from the United States and

internationally, will not adequately compensate the demand created by retiring pathologists by 2030.³ The decline in interest among medical students may be attributed to lack of exposure to pathology in medical school curriculum and negative perceptions of the field online. Two recent studies indicated that only 17% of doctor of osteopathy (DO) and 12% of MD respondents answered “strongly agree” or “agree” to the prompt: information about pathology on social media is encouraging.^{4,5}

The majority of medical students decide upon a career specialty during their third or fourth year of medical school.⁴ Seventy-six percent (76%) of students rated the role of clerkship experience in specialty choice as either extremely significant or significant in one survey.⁶ The second most recorded time that students decide on a specialty is before entering medical school.^{5,7} However, there is data to suggest that the majority of students do not apply for their initially stated residency choice.⁸ Studies have shown that most allopathic and osteopathic medical students do not have a required pathology clerkship, and few have elective pathology rotation opportunities.⁵ Medical students who consider applying for pathology residencies report participation in elective rotations during their clinical years, gross anatomy demonstrations, and participation in

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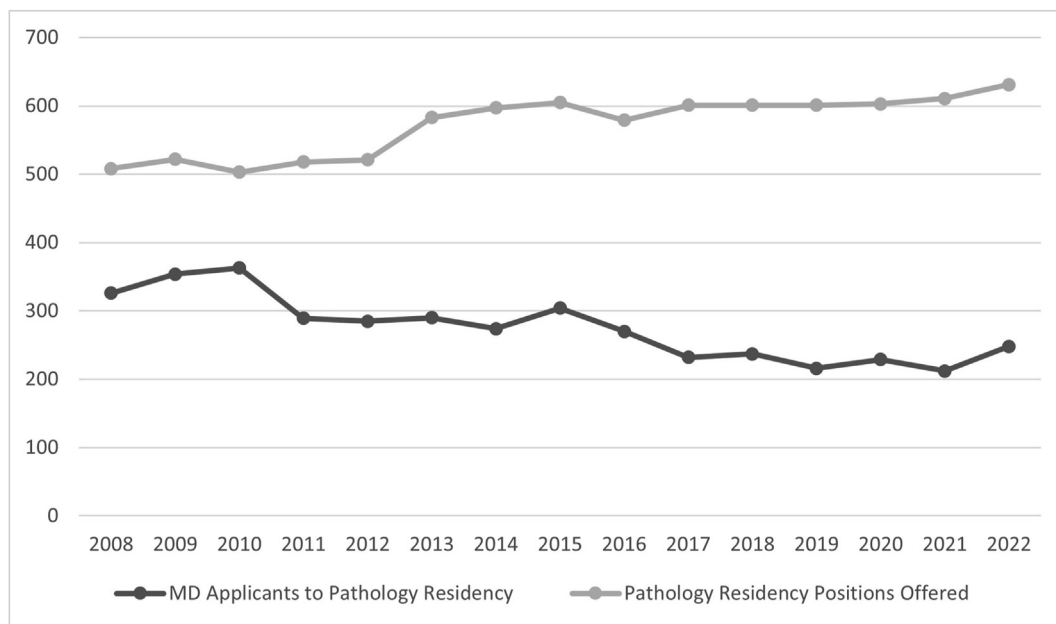


Fig. 1. Pathology residency positions offered and senior applicants from United States allopathic schools to those positions from 2008 to 2022. Permission to publish the data obtained from the National Resident Matching Program (<https://www.nrmp.org/match-data-analytics/archives/>; National Resident Matching Program, Results and Data: 2022 Main Residency Match®. National Resident Matching Program, Washington, DC. 2022.).

pathology-based research opportunities as driving factors for their decision.^{5,7} Similar studies aimed at determining rationales for residency applications have been performed for orthopedics,⁴ diagnostic radiology,⁹ and for first-year medical students in general.¹⁰ A study has shown that first-year medical students with no prior experience in pathology reported both negative and positive opinions regarding the career field, suggesting that students are being influenced outside of the healthcare community.¹¹ Outside opinions, specifically from the internet, have been influential in propagating the perception of specialties.^{5,7} Pathologists have been negatively stereotyped by medical students as “geeky” and “antisocial.”¹² Efforts to identify online deterrents to the specialty include one study which analyzed pathology threads of the Student Doctor Network, a website used by medical students during their residency application. Thread reviewers agreed that medical students who viewed these threads were less likely to consider a pathology residency.¹³

Pre-residency exposure to pathology as a specialty has been well received by students and consequently had a positive effect on the perceptions of the field.^{11,14–18} Several medical programs have made efforts to increase exposure to pathology by requiring clinical rotations in the specialty,¹⁸ integrating pathology into established clerkships,¹⁵ or by offering post-sophomore fellowships.^{19,20} There have also been attempts to foster interest in pathology during undergraduate medical education by implementing informational sessions on specialty choice¹⁶ and integrating pathology into the gross anatomy lab.^{14,17} Several studies have shown that gross anatomy dissection enables the unique integration of pathology, clinical medicine, and anatomy during undergraduate medical education.^{21,22} Problems applying these integrated approaches have stemmed from time constraints on faculty and students.^{15,17,18} By introducing medical students to pathology through a two-day project organized by a student specialty interest group, the authors present an intervention that can be efficiently implemented by medical educators to increase medical student knowledge of pathology as a career.

Materials and methods

The authors conducted an intervention to better understand the exposure that medical students had to the field of pathology. Six first-year medical students were recruited via an email sent to members of

the Pathology Student Interest Group at the University of Tennessee Health Science Center (UTHSC) College of Medicine explaining the purpose of the intervention. Five out of the six recruited participants completed both sessions and surveys. An hour before the activity, the participants completed a pre-intervention survey assessing their general knowledge of pathology as a specialty and of pathology skills and techniques. The participants created and recorded a 5-digit code on the pre- and post-intervention surveys to ensure anonymity. The pre-survey asked specifically about previous experience in the field of pathology, the current specialty interest, and student knowledge of pathology as a career including the skills and techniques required. Participant survey responses were collected via binary questions, short answer, and a five-point Likert scale. The intervention was conducted in two sessions on April 7th, 2022, and April 19th, 2022, respectively. During the first session immediately following the pre-survey, participants were escorted to the Gross Anatomy Laboratory where they biopsied various cadaver tissue under the guidance of a UTHSC anatomy professor. Using tools provided by the UTHSC Department of Anatomy and Neurobiology, tissues including median nerve, lung, transplanted kidney, artery, and thyroid were collected. Immediately following biopsy, the participants observed the standard tissue processing of the collected samples by shadowing a UTHSC faculty histotechnologist. The participants observed the various stages of tissue preparation including tissue fixation, cassettes transfer, tissue processing, sectioning via microtome, and staining. During the second session, students examined the samples at a multi-head microscope and discussed the clinical findings with a UTHSC faculty pathologist. After the intervention, participants had several days to complete the post-intervention survey which specifically asked about their general knowledge of pathology as a career and the skills and techniques required to perform tasks for the career relative to their understanding before the event. The survey also requested post-intervention feedback to ascertain whether certain aspects of the intervention were useful and impacted their current interest in pursuing a career as a pathologist.

Results

All five students (3 male, 2 female) had a BA/BS degree as their highest level of education. Only one student who had 4 years of

experience as a medical laboratory scientist indicated having previous opportunity to shadow a pathologist. Two students stipulated an interest in internal medicine, one in radiology, one in forensic pathology or radiology, and one student was undecided. Students were asked what their current interest in pursuing a career as a pathologist was on a 10-point scale with 10 being the most interested. Responses ranged from 5 to 8 with a median of 6 and mean \pm standard deviation of 6.4 ± 1.14 . Students were also asked how likely they were to pursue a career in pathology on a 10-point scale. Responses ranged from 4 to 8 with a median of 6 and mean \pm standard deviation of 6.0 ± 1.58 . Responses to “what are some factors that limit your interest in pathology” included [career] redundancy, [perceived lack of] exposure [to patients], [lack of] understanding [the field of pathology], [uninterested in the] day-to-day life, lack of direct patient care, lack of knowledge of the work or lifestyle, and spending a lot of time at a microscope. Four of the five students responded that they understood pathology as a medical specialty somewhat well and the fifth student understood it well. Three of five students indicated that they understand the roles and responsibilities of a pathologist somewhat well, one student responded not very well, and one student responded well. Post-activity survey results indicated that participation increased their knowledge of pathology as a career with a median increase of 0.8 points (range: 0.2 to 1.6) on a 5-point Likert scale (Tables 1–3). Students also indicated that participation increased their knowledge of pathology skills and techniques—median increase of 1.2 (range: 0.8 to 1.8). After the activity, two students indicated an interest in pathology as a specialty, one indicated a moderate interest, and one was not interested. One student stated that although his or her interest in pathology had increased, another specific field of medicine was of more interest. Post-project feedback was unanimously positive with students scoring a 4.13 ± 0.46 on a 5-point Likert scale with 5 being “strongly agree” to the question prompt. Responses to “what components of this project did you enjoy the most” included collecting the gross tissue samples, processing of tissues and staining, and examining slides with a pathologist. Responses to “what components of this project did you enjoy

the least” included tissue preparation and the need to come in on different days for different aspects of the project.

Discussion

Facilitating an integrative pathology project via a medical student specialty interest group can increase awareness about the roles and responsibilities of a pathologist. Given the generally limited contact between undergraduate medical students and the field of pathology, this student interest group activity was a novel way to expose students to the specialty before clerkships. Medical students are more likely to make an informed choice regarding elective clerkships after participating in an early intervention activity.²³ Similar studies have been done in other specialties that receive little attention during the pre-clinical years including urology²⁴ and neurosurgery.²⁵ Limitations to this pilot study include the small student sample size and inclusion of only allopathic students. Continuing this activity for additional years would increase the overall sample size. A similar intervention could also be implemented for osteopathic medical students due to the overall increase in the number of pathology residency applicants from osteopathic medical schools in recent years.⁷ While the student sample size was small, the response rate to surveys was high. Although six students participated in the event, all but one filled out both the pre- and post-survey responses resulting in an 83.3% response rate. Larger sample sizes are predicted to have similar outcomes where student response rate is high, knowledge of the career is increased, and participation could lead to increased applications to pathology residencies. Another limitation of this pilot study was the short duration of a two-day experience which provided only a cursory overview of an entire specialty and lacked student exposure to all the sub-specialties of pathology. A long-term goal of this study is to continue this project on a yearly basis and track student applications to residencies.

Events including the current study as well as interest group luncheons with speakers and other efforts to increase student awareness may be effective as demonstrated by the measurable growth in the number of

Table 1

Survey questions that pertained to student general understanding of pathology as a career.

Prompt	Pre-survey results	Post-survey results
I have an understanding of the difference between anatomical and clinical pathology	2.8 ± 0.84	4.0 ± 0
I understand the role of a pathologist in diagnosing a disease	3.8 ± 0.45	4.0 ± 0
I have an understanding of the role a pathologist plays in the prognosis of a patient.	3.2 ± 0.84	4.0 ± 0
have an understanding of the patient interactions a clinical pathologist has	2.0 ± 0.7	3.6 ± 0.55
I understand the difference between an academic and private practice pathologist	2.8 ± 0.84	3.4 ± 0.55

Table 2

Survey questions that pertained to student general knowledge of pathology skills and techniques.

Prompt	Pre-survey results	Post-survey results
I am comfortable in identifying the process of preparing a specimen for histology	2.2 ± 1.09	4.0 ± 0
I am comfortable in identifying the types of stains used in pathology	2.4 ± 0.89	3.2 ± 0.84
I have an understanding of when to use different stains for different purposes	1.6 ± 0.55	3.2 ± 0.84
I am comfortable in reading a prepared slide for the clinical purpose of diagnosis	2.4 ± 0.55	3.4 ± 0.89
I am comfortable in differentiating between normal and pathological tissue parenchyma	2.4 ± 0.55	3.6 ± 0.89

Table 3

Survey questions that requesting post-project feedback.

Prompt	Post-survey results
This project improved my understanding of the practice of pathology	4.2 ± 0.45
This project provided me ample opportunity to see how the tools of pathology are utilized by different members of the pathology team	4.0 ± 0.71
I am more aware of pathology as a medical practice and laboratory science because of this project	4.2 ± 0.45
Correlating gross examination findings with microscopic findings helped me better understand disease pathogenesis	4.4 ± 0.55
My understanding of pathology as a potential career has improved	3.8 ± 0.45
Microscopic examination of lesions helped me better understand the pathologists' role in patient management	4.2 ± 0.45
I had the opportunity to network with other students with a growing interest in pathology	4.2 ± 0.45
I had the opportunity to network with physicians who practice clinical pathology	4.0 ± 0.0

pathology residency applications in 2022. The increase in expanded pathology residency applications may also be a result of community recruiting efforts or may be a reflection that students are more interested in careers that provide more work-life balance compared to the top 15 other major specialties medical students choose for residency. The recent and ongoing pandemic has changed many aspects of the medical profession and pathology may be benefiting from student interest based on this phenomenon.

While this study is not the first presentation of an event to increase student knowledge of pathology,^{14,21,22} it does involve multiple departments from a health science center. Most of the cited efforts to increase student interest, regardless of specialty, are at the expense of faculty time. Benefits of this event included impacting student awareness without significantly increasing time obligations of faculty. The efforts were split among faculty in separate departments; therefore, the time requirement was divided and did not heavily burden a single faculty member. Students organized this event and the anatomist participated on one day for approximately 1 h. The histotechnologist presented methods for tissue preparation and staining for 4 h over the course of two days. The pathologist spent 1 h reviewing the slides with students and discussing the career path to pathology. Events such as these not only benefit students and the pathology profession, but also increase inter-professional collaboration among faculty. Future studies could include pairing histotechnologist students with first-year medical students to present various aspects of tissue processing and staining which could increase student interprofessional activity. This event could include additional students. We hypothesize a small group of 20 or fewer would be the most beneficial for this learning experience. Additional students may require additional time spent with the activity or devoted by faculty members. If time is a constraint, this activity could occur each semester to allow more students to participate.

Conclusions

This investigation demonstrated one easily implemented method to increase medical students' general knowledge of pathology as a career, a field deficient in qualified personnel. Similar events could be beneficial to histotechnology students as well and could integrate interprofessional relationships among student groups. If implemented annually for first-year medical students, there is potential to perpetuate the increased trend in pathology residency applications.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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