Contents lists available at ScienceDirect

Academic Pathology 11/2 (2024) 100112

Academic Pathology

journal homepage: www.journals.elsevier.com/academic-pathology

Regular Article

The impact of Pathology Outreach Program (POP) on United States and Canadian high school students

Casey Schukow, DO [a], Curtiss Johnson, BA [b], Sophia Martinez [c,1], Kaitlyn Mckinley [d,1], Katelynn Campbell, MD [e], Aadil Ahmed, MD [f,g,*]

[a] Department of Pathology, Corewell Health, Royal Oak, MI, USA
[b] Michigan State University College of Osteopathic Medicine, East Lansing, MI, USA
[c] Fordham University, The Bronx, NY, USA
[d] Loyola University Chicago, Chicago, IL, USA
[e] Department of Pathology, University of Saskatchewan, Saskatoon, SK, Canada
[f] Department of Pathology and Laboratory Medicine, Loyola Stritch School of Medicine, Maywood, IL, USA
[g] Dermatopathology Section, Illinois Dermatology Institute, Park Ridge, IL, USA

A B S T R A C T

Given recent trends in National Resident Matching Program (NRMP) data, there exists a looming deficit of practicing pathologists. As such, the Pathology Outreach Program (POP) was established in 2018 in the United States, and in 2022 in Canada, to educate high school students about pathology and laboratory medicine to help curb this projected shortage. We present survey data gathered from several educational sessions hosted at high schools in the United States (U.S.) and Canada over a 5-year period comparing participants' perceptions and awareness of pathology both before and after each session. Using this data, we wish to highlight the positive impact of POP on increasing students' awareness and appreciation for careers in pathology or laboratory medicine. This data will also highlight the additional work that must be done to further boost public knowledge of laboratory medicine's contributions to patient care. We hope this project will lay the foundation for further improvements to laboratory visibility and inspire additional outreach efforts to mitigate a future workforce shortage.

Keywords: Advocacy, Awareness, Education, Laboratory medicine, Outreach, Pathology, Social media

Introduction

In recent years, the number of U.S. medical students applying for and matching into postgraduate year 1 (PGY1) pathology residency positions has been steadily decreasing. Based on data published by the NRMP, McCloskey et al. acknowledged a greater than 11% decrease in US allopathic seniors filling PGY1 pathology residency positions from 2015 (46.6%) to 2020 (33.8%).[1] This downward trend continued in 2021 (32.4%).[2] However, according to NRMP data published after the 2023 Main Residency Match, 39.5% (242 students) of U.S. allopathic seniors filled the 613 available PGY1 residency positions among 166 participating programs, which is a 7.1% increase from 2021.[3] Furthermore, a 5.2% increase in U.S. osteopathic seniors was also seen in 2023 (14.2%, or 87 out of 613 available PGY1 positions) from 2021 (9.0%, or 55 out of 611 available PGY1 positions).[2,3] While this most recent data is encouraging, there is a current U.S. pathologist shortage exacerbated by both a wave of retiring pathologists and limited medical student exposure to formal pathology and clinical laboratory medicine training.[4]

Organized efforts to recruit medical students at an institutional and national level are underway, highlighting that early exposure to pathology is imperative. However, outreach programs targeting high school students help cast a wider net regarding exposure and recruitment, as high school students often begin considering their future career paths near the end of their secondary education.[5] Multiple institutions and medical specialties have invested in organized programs such as Science Technology Engineering and Mathematics (STEM), which offer exposure to different medical specialties, especially among underrepresented communities. Whether establishing a semester-long course or engaging in one-time sessions, evidence from these programs support the effectiveness of outreach programs in increasing exposure and awareness in the content areas presented.[6,7] As such, we aim to establish the Pathology Outreach Program (POP) as an outreach program that will serve to increase pathology and laboratory medicine exposure among high school students, and ideally lead to an increased future workforce in the field.

In 2018, the senior author of this study (AA) established the POP, where he began promoting pathology and laboratory medicine via interactive sessions to high school students.[8] This program was designed to expose career pathways and increase awareness about pathology

* Corresponding author. Department of Pathology & Laboratory Medicine, Loyola Stritch School of Medicine, Maywood, IL, USA.
E-mail address: aahmed33@luc.edu (A. Ahmed).
[1] Both authors contributed equally to this work.

https://doi.org/10.1016/j.acpath.2024.100112
Received 21 October 2023; Received in revised form 1 January 2024; Accepted 28 January 2024, Available online xxxx
eISSN2374-2895/

among the public as consumers of medicine. The goal of this study is to show if POP sessions changed perceptions and increased awareness about pathology.

Materials and methods

Fifteen in-person sessions, each approximately 1 h in length, occurred between 2018 and 2023 in eleven high schools in Illinois, Michigan, and Saskatchewan; an image collage of some of these sessions is shown in Fig. 1. Session facilitators included practicing pathologists, residents, and medical student volunteers, as well as medical laboratory professionals (pathologists' assistants and cytotechnologists). Participants consisted of high school students (grade levels 9–12) from a mix of demographic locations including urban (n = 5), suburban (n = 5), and rural (n = 1) schools, along with their teachers. About half of the schools had some initiatives in place that were geared towards careers in health sciences; however, none of the schools had prior programs related to the field of pathology and/or laboratory medicine. The sessions consisted of an interactive PowerPoint presentation that involved open-ended questions and discussion about pathology, its role in patient care, pathology workflow, career pathways (pathology and laboratory professions) with estimated salaries compared to other specialties, future directions, and ending with simplified clinical case-based problems highlighting the importance of pathology in patient care. Before ("pre-course") and after ("post-course") each session, a survey questionnaire on Google Forms was distributed to students in attendance which they could voluntarily and anonymously complete (Supplemental material 1). Survey items contained single selection, open-ended, and Likert scale questions related to participants' awareness of pathology as a career, perceptions of the field and work pathologists perform, interest in pursuing pathology or laboratory medicine in the future, appreciation for the role of social media in promoting pathology, and overall impressions of the POP session itself. Survey items were developed by the senior author of this study (AA) based on clearly defined objectives of the overall program and the parameters to be measured. The author's prior experience in survey studies and questionnaire development added to the face and content validity of the questionnaire items. Simplified language was used to avoid any misinterpretation while double-barreled and leading questions were avoided. The answer options included every possible response for each item. The survey was reviewed after the first session (pilot session) to identify any errors based on responses. Questions with numerical and categorical responses were analyzed on Microsoft Excel (version 16.80) and results including graphs with cumulative scores were generated. Open comments were qualitatively analyzed, grouped by comment themes, coded by numbers, and subsequently converted to graphical format.

Results

The pre-session survey had 424 responses. Of these students, 71% were inclined towards a career in medicine or allied fields. Only half of the respondents (53%) had previously heard about the field of pathology. Similarly, approximately half of the respondents (49%) did not know what pathologists do. More than half (58%) of the students were not sure if a pathologist's role was limited to what is portrayed on popular television shows such as Crime Scene Investigation (CSI). About one-third (33%) of students either negated or were not sure about the role of pathologists in patient care either. Open-ended comments about what students know about pathology are shown in Table 1. Only 24 students (6.6%) were able to correctly identify the role of A pathologist.

Table 1
Open-ended responses to the question 'What do you know about pathology?'

Response code	Response theme	No. of Respondents
1	Nothing/not much	176
2	Study of disease	142
3	Examines human body organ/tissue/fluid for diagnosis	24
4	Deals with dead people/forensics/autopsies	15
5	Speech pathology	06

Fig. 1. POP sessions, conducted by authors (consent for photo and publication verbally taken at the time of sessions).

Additionally, over two-thirds (78%) did not know the educational pathway to become a pathologist or a laboratory professional while 18% had some idea. Not surprisingly, 89% of respondents had never met a pathologist before.

The post-session survey had 356 responses (84% retention). Nearly all students (96%) affirmed that the course increased their understanding about pathologists' role in patient care. More than half of the students (63%) thought that the course helped eliminate misconceptions about pathologists while 37% believed that they didn't have any misconceptions Seven students (2%) responded that the course did not help alleviate their misconceptions. Most students (94%) felt informed or strongly informed about career pathways/options in pathology, compared to only 4% who felt informed about career pathways in the pre-survey. About one-third of the students (30%) felt interested in considering pathology or allied fields as a career option, one-third (31%) remained neutral and the remaining 39% denied interest. However, 71% of respondents were interested in learning more about the field in the future.

The comparative results of two statements in pre- and post-survey regarding the value of pathologists' work and the field of pathology being fulfilling are shown in Figs. 2 and 3, respectively. Over 80% of the students gave the course an overall rating of 8 or higher as shown in Fig. 4. Regarding social media, more than half of the students (62%) learned that there is a positive or influential role of Twitter in pathology; however, 41% of students would have preferred to see pathology/pathologists' activity on TikTok and another 41% aspired for pathology content on Instagram.

Discussion

While the overall value of this data is yet to be fully explored, these results are promising. Many respondents held previous interest in medicine as a career, which may serve as a sampling bias in one regard, but in another, serves to highlight the severity of the exposure problem, as half of the students among those already interested in medicine had never heard of pathology before. Far fewer students reported any formal exposure or experience with pathologists, and perhaps the most striking result was students' unawareness of the basic education and career pathway required to become a pathologist. This suggests that many more students who were not in attendance are similarly blind to the role pathologists have in patient care, further illustrating the need for additional outreach and education to address public awareness and misconceptions related to the field.

These results, taken together, are a positive indicator of the potential success that POP and other outreach programs may have in recruiting students to pathology and laboratory medicine moving forward. However, there were fewer students who would consider pursuing pathology or a laboratory medicine field because of session attendance. At this stage, it is difficult to predict the true impact of POP on guiding students towards the field. It would be worthwhile to consider longitudinal evaluation and possible follow-up studies to recapitulate the effects of early education and career guidance on students' desires to enter pathology and laboratory medicine as a result of these sessions. We are, however, pleased to inform our readers that two of the authors in this study are attendees of POP, with a strong inclination towards pursuing a pathology career.

Perhaps the most ambitious follow-up to this project would be a longitudinal study tracking the number of students who later pursue a career in pathology or laboratory medicine after attending a POP session in high school. Previous studies in this vein have mostly explored medical students' perceptions and desires to pursue pathology through survey data gathered after the implementation of experimental curricula (including dedicated pathology courses) at several U.S. and Canadian institutions.[9,10,11] Overarching themes from data analysis of these studies include moderately improved awareness of the daily duties, training requirements, and lifestyle of pathologists, with miniscule improvements in the number of students showing an interest in pathology or self-reported likelihood of entering the field.[9,10,11] This highlights the need for continuous outreach and exposure programs that could offer a platform to identify specific shortcomings in recruitment, education,

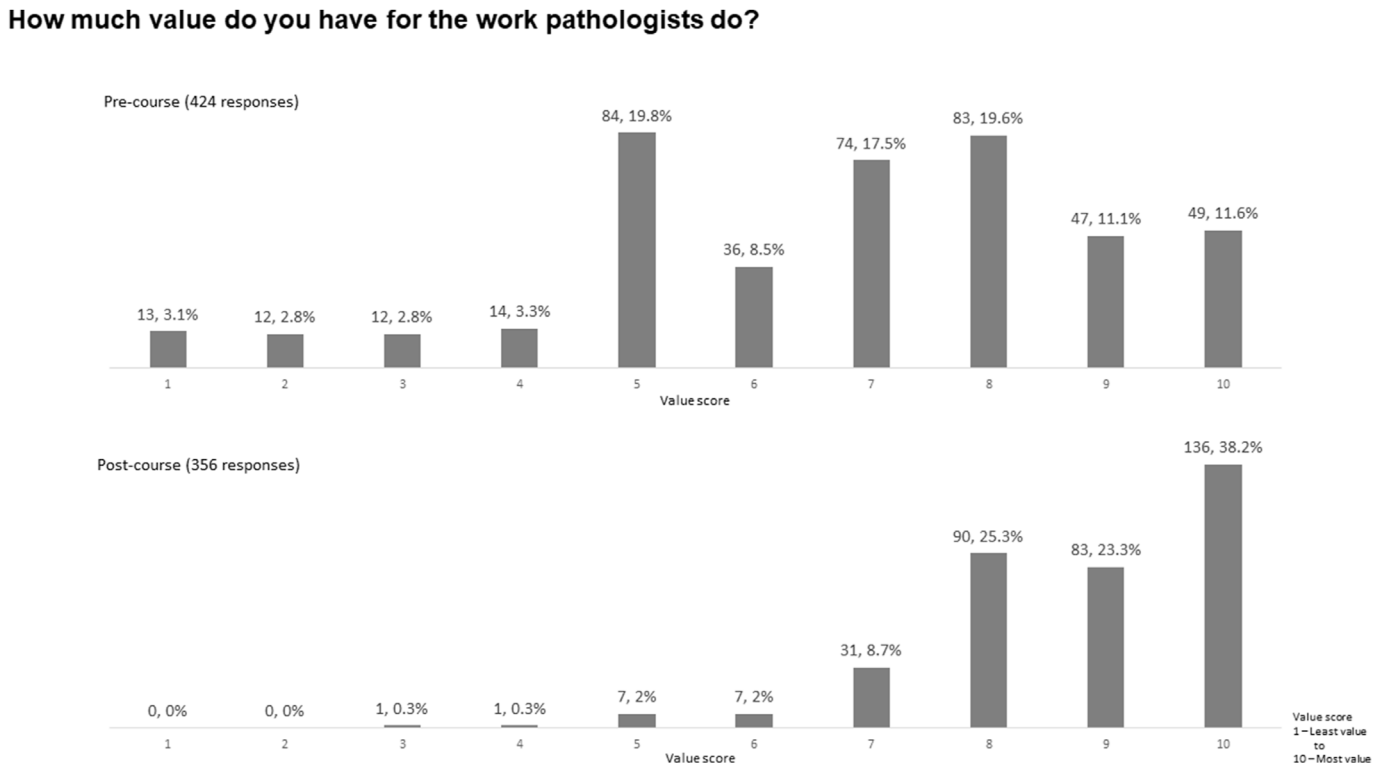

Fig. 2. Pre- and post-course improvement in the responses for the value of work pathologists Do.

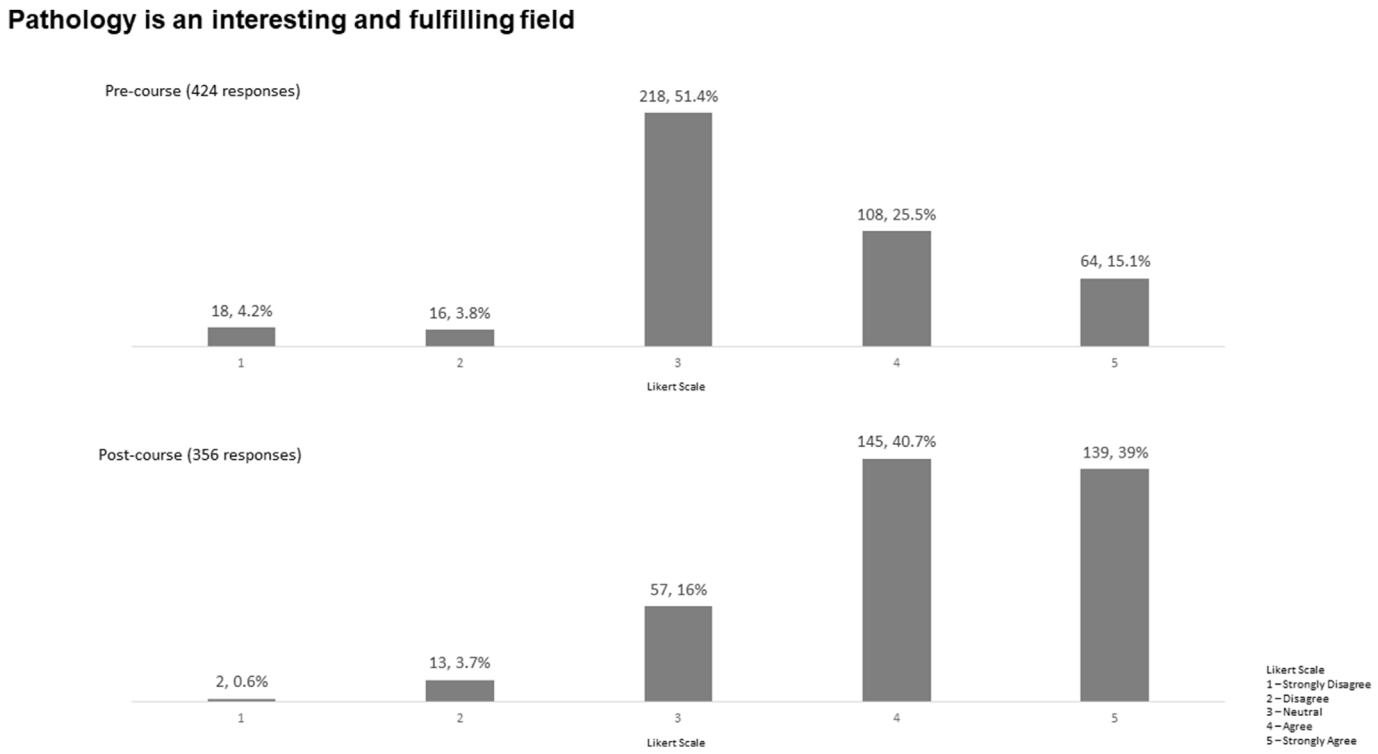

Fig. 3. Pre- and post-course result showing positive skewing in response to 'pathology being a fulfilling field'.

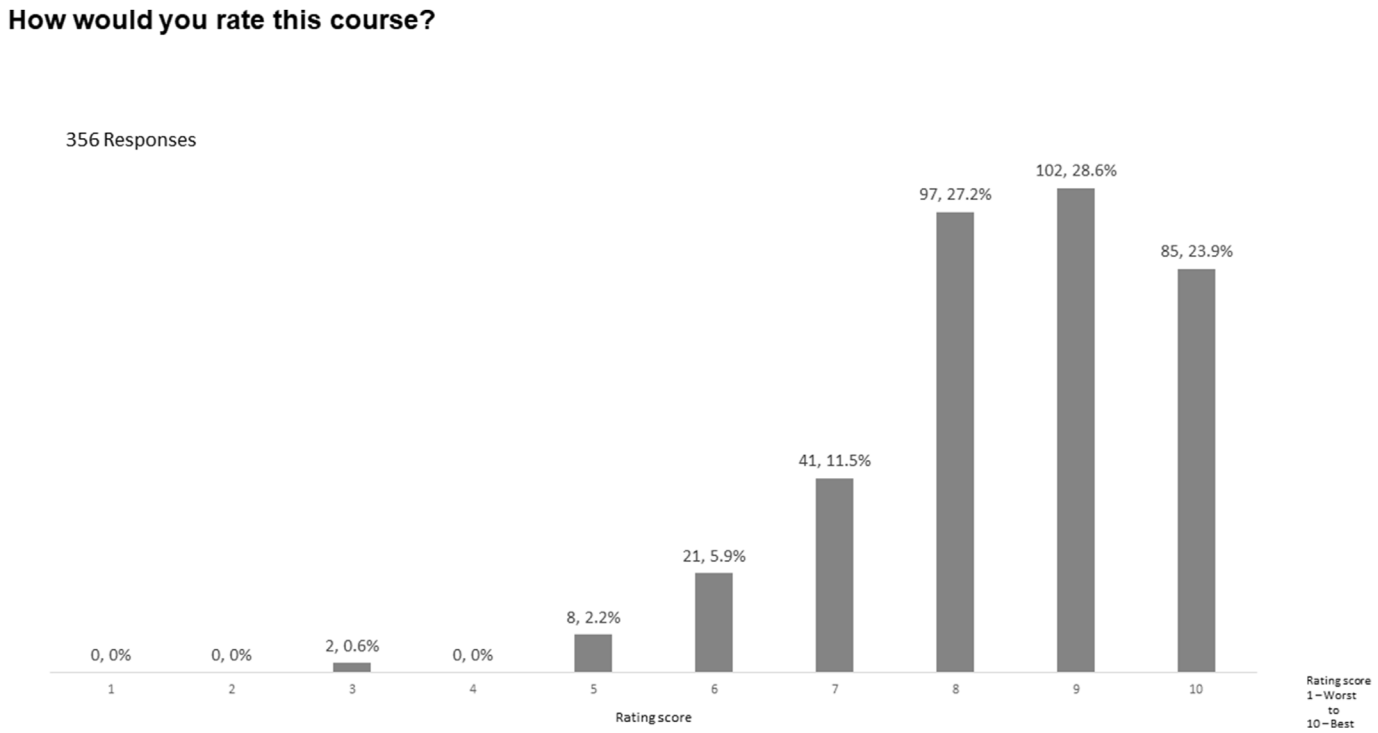

Fig. 4. Student responses capturing overall rating of the course.

training, and retention of students who may be future pathologists. This may also help dictate how school administrators and other leaders in the field approach topics such as community outreach, curriculum planning, and career development to maximize the impact of such programming. Support from national pathology organizations may also help organize these efforts on a national level.

POP survey data also points to the potential role of social media in promoting pathology. Historically, popular websites utilized by medical students such as Student Doctor Network (SDN) and Reddit have largely portrayed pathology in a negative light. Common themes that dominate discussions of pathology on these platforms include a perceived poor future job market, low salaries, mundane work, and an overall lack of

respect for pathologists compared to other physician specialties.[1,12,13] Considering that many medical students use the internet/social media as a tool to research pathology as a potential career[1], these negative portrayals have likely dissuaded many potential applicants from entering the field over the years. This suggests an avenue exists to increase positive messaging and content on social media platforms by practicing pathologists and professional organizations to help combat misinformation and renew interest in the laboratory fields.

More recently, platforms such as Twitter, Instagram, and TikTok have emerged as methods to inform students about pathology and laboratory medicine, but few studies have broached the topic of social media as a recruitment tool before. Schukow et al. highlighted the role that Twitter and TikTok have played in promoting pathology to students in a more positive manner, and given the recent explosion in worldwide users, these platforms are likely to play a role in the future of social media utilization in pathology and laboratory medicine.[14] While it is encouraging that many students acknowledged the influential role Twitter has in pathology because of these sessions, many students preferred other platforms such as TikTok and Instagram over Twitter. This suggests that POP and other programs may benefit from expanding social media presence to additional platforms, with the goal of integrating content in a succinct yet impactful manner that will appeal to students of this and future generations.

Exploring student misconceptions about pathology would also be a logical research progression based on this study data. Many students affirmed that sessions helped eliminate any misconceptions they may have harbored about pathologists. This highlights a key point of contention in the field: lack of public awareness of the day-to-day work tasks and contributions of pathologists to patient care. In the eyes of the public, pathologists have traditionally been associated with forensics and autopsy work, with personalities much akin to the "quirky" or "socially awkward" individuals portrayed in television shows and mainstream media.[15] Furthermore, there exists little (if any) formal exposure to the daily practices of pathologists in medical school, with a majority of information regarding the field coming from traditional lectures in first- and second-year curricula and voluntary rotations in the third and fourth year.[1,11,15] Common themes from previously referenced studies regarding dissuading factors to enter pathology include: lack of direct patient contact, little prestige/visibility relative to other physicians, dislike for microscope/laboratory work, low pay, and a poor future job market.[1,11,12,15] Given this data and previously mentioned social media concerns, there is clear room for improvement in increasing exposure and addressing misconceptions about pathology earlier in medical training.

The available data and prior research on this topic point to one fact: pathology and laboratory medicine require better advocacy and self-promotional campaigns. By discovering student opinions of pathology and potential biases, the collective leaders, practicing physicians, and current trainees in the field may presumably develop goal-oriented initiatives to address these issues and paint pathology in a more positive light moving forward, such that more individuals may be drawn into the profession.

This study has a few limitations. Since survey participation was voluntary, it is difficult to say whether the actual number of responses aligned with the true number of students in attendance for each session when accounting for those who attended but chose not to fill out either survey. In addition, the number of sessions performed, and schools visited, while adequate for data collection in this study, may not be completely representative of the diverse population of U.S. and Canadian high school students. Considering the parameters operated under (different geographic locations, 1-h timeframe, pre-made presentation, etc.), this design did not lend itself to more robust sampling methods or statistical analyses which may have elucidated additional findings. There is also potential for confounding factors, including but not limited to students' current grade level or academic achievements, overall curriculum rigor, individual school funding, and educational resources, among others. Lastly, time constraints allowed for limited information about other career pathways such as pathologist assistants, medical laboratory scientists, and histology technicians. Feedback regarding the course over this 5-year period included desires to avoid medical jargon and including more hands-on experience with microscope slides/samples, but interactive discussions and a personable approach with students have also helped us improve these sessions.

Despite these limitations, the results of this study and personal handwritten notes and video messages received from students are far more fulfilling than what we had expected at the onset of this program.

Conclusion

In totality, preliminary data from these POP sessions is encouraging. We emphasize the need for continued efforts and support from pathologists on a national level, with the goal that POP and other outreach programs will ultimately represent a catalyst for perception change at the grassroots level. Presumably, the more sessions and overall recognition that POP achieves, the more informed students will be about pathology and the various career pathways the laboratory offers.

Funding

The article processing fee for this article was funded by an Open Access Award given by the Society of '67, which supports the mission of the Association of Pathology Chairs to produce the next generation of outstanding investigators and educational scholars in the field of pathology. This award helps to promote the publication of high-quality original scholarship in *Academic Pathology* by authors at an early stage of academic development.

Note

Pre-course survey results were presented at the 2022 ASCP annual meeting in Chicago, IL whereas post-course survey results with comparative analysis were presented at the 2023 USCAP annual meeting in New Orleans, LA.

Declaration of competing 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 paper.

Acknowledgments

We thank Dr. Ahmed for his founding and contributions to the POP including session PowerPoints, preliminary data analysis, and continued support for this endeavor. We also thank volunteer presenters for their role in delivering this content and data gathering.

Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.acpath.2024.100112.

References

1. McCloskey CB, Johnson K, Brissette M, et al. Factors influencing US allopathic medical students to choose pathology as a specialty. *Acad Pathol*. 2020;7:2374289520951924. doi:10.1177/2374289520951924.
2. *Results and Data: Main Residency Match 2021*. National Resident Matching Program; Published 2021. Accessed May 18, 2022 https://www.nrmp.org/wp-content/uploads/2021/08/MRMResults_and-Data_2021.pdf.
3. Advanced-Data Tables. *2023 Main Residency Match Results*. National Resident Matching Program; Published 2023. Accessed July 6, 2023 https://www.nrmp.org/wp-content/uploads/2023/05/2023-Main-Match-Results-and-Data-Book-FINAL.pdf.
4. Raich M. *Pathology Job Market Struggling to Meet Increasing Demand*. Vachettepathology.com; 2022. Published March 21 . Accessed May 18, 2022.
5. Muncan B, Majumder N, Tudose N. From high school to hospital: how early exposure to healthcare affects adolescent career ideas. *Int J Med Educ*. 2016;7:370–371. doi:10.5116/ijme.5801.f2cc.

6. Horslen LC, Kotova S, Hankins V, et al. CHEST watch: a high school outreach program. *Semin Thorac Cardiovasc Surg*. 2021. doi:10.1053/j.semtcvs.2021.07.013. S1043-0679(21)00325-00327.
7. Herek TA, Branick C, Pawloski RW, et al. Cancer biology and you: an interactive learning event for native American high school students to increase their understanding of cancer, causes, prevention, and treatment, and to foster an interest in cancer-related careers. *J STEM Outreach*. 2019;2(1). doi:10.15695/jstem/v2i1.16, 10.15695/jstem/v2i1.16.
8. @pathoutprogram. *POP (Pathology Outreach Program)*. Twitter; 2017. Published October. Accessed May 18, 2022 https://twitter.com/pathoutprogram.
9. Al Nemer A. Undergraduate medical students' perception of pathology. *Ann Diagn Pathol*. 2020;44:2019–2021. doi:10.1016/j.anndiagpath.2019.151422.
10. Walsh JC, Padgett J, Weir MM, Chahine S, Comparing Perceptions of Pathology as a Medical. Specialty between Canadian pathologists and pre-clinical medical students. *Med Sci Educ*. 2018;28(4):625–632. doi:10.1007/s40670-018-0596-4.
11. Holland L, Bosch B. Medical students' perceptions of pathology and the effect of the second-year pathology course. *Hum Pathol*. 2006;37(1):1–8. doi:10.1016/j.humpath.2005.10.004.
12. Jajosky RP, Banks M, Jajosky AN. Concerns about the pathology job market dominate a popular online pathology forum and likely deterred American medical students from pursuing pathology residency. *Heliyon*. 2019;5(9), e02400. doi:10.1016/j.heliyon.2019.e02400.
13. Schukow CP, Booth AL, Mirza KM, JajoskyRP. #PathTwitter A positive platform where medical students can engage the pathology community. *Arch Pathol Lab Med*. 2023;147(2):135–136. doi:10.1093/ajcp/aqab065.
14. Schukow CP, Herman M, Kowalski P. TikTok: the New "social media frontier" in pathology?. Adv Anat Pathol. 29(5):324-325. doi:10.1097/PAP.0000000000000350.
15. Hernandez PV, Razzano D, Riddle ND, et al. Measuring the efficacy of pathology career recruitment strategies in US medical students. *Arch Pathol Lab Med*. 2022;146(4):494–500. doi:10.5858/arpa.2020-0834-OA.