Measuring the Efficacy of Pathology Career Recruitment Strategies in US Medical Students

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• ***Context.***—**Multiple articles and surveys in the literature suggest that medical students find a career in pathology undesirable and believe it is disproportionately focused primarily on the autopsy.**

Objective.—**To measure the effect of applied interventions on medical student attitudes about the field of pathology.**

Design.—**This prospective study involving medical students from first through fourth year was conducted as a pilot study in 2 medical schools in the United States. A 2-part anonymous survey regarding interest in pathology as a career and familiarity with the specialty using a 10-point scale was given to first- and second-year medical students before and after they listened to a 10-minute pathology career presentation. The same survey was given to third- and fourth-year medical students before and after a 4-week pathology elective.**

Results.—**A total of 121 and 83 students responded to the survey before and after the intervention, respectively. Of the 121 students who responded to the survey before the intervention, 106 (87.6%) had not spent significant time in a pathology laboratory before the intervention. The majority of responses in interest in career, job responsibilities, and features of pathologists before and after the intervention demonstrated a statistically significant difference ($P < .001$). We compared survey scores of presentation versus 4-week rotation groups before and after the intervention. Students who experienced the presentation did not differ from students who experienced the rotation in the majority of questions related to interest in career, job responsibilities, and features of pathologists.**

Conclusions.—**Our study suggests that pathology exposure strategies can have a beneficial effect on student perceptions of the field and consideration of a career in pathology. Overall, the presentation intervention seemed to have the greatest effect on the first- and second-year students.**

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Through in-depth study of the fundamental principles of diseases, with special focus on associated structural and functional changes, pathology integrates the basic sciences with the clinical practice of medicine and serves a critical role in patient care. There is no single historic event that demarcates the beginning of pathology as a defined area of interest for early medical practitioners.[1] Rudolf Virchow, considered the father of cellular pathology, consolidated the idea of cellular changes as the basis of disease and emphasized the importance of autopsy to medicine.[2] He believed that ensuring the health of the community could be achieved only with doctors who understood the origin, manifestations, and progression of disease in order to adequately care for their patients.[3] As reported in the United States and in many other countries, however, medical students' interest in pathology has decreased.[4–7] There has been a nearly 30% decrease in the number of applicants to pathology residencies from American medical graduates since 2008.[8] One possible explanation for that is a perception that pathology is a discipline that is primarily concerned with forensic and medicolegal investigations.[4,9] It

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is also generally known that there is an unfortunate multitude of negative stereotypes circulating about pathologists themselves. For example, prior studies have shown that pathologists have been understood to be "poor communicators, socially inept, unfriendly, having Asperger's personalities" as described by medical students and physicians in attending roles.[10] There are also negative messages spread about pathologists in mainstream media outside of the hospital setting, as evidenced by television shows portraying socially awkward persons relegated to a career in pathology.[10–12]

Compounding the problem, in many medical schools, the exposure that students have to pathology usually does not include the practice of pathologists in the real world.[4,9] Rather, medical students are exposed only to pathology content–based lectures that focus on disease processes and do not inform students of the pathologist's daily practice, thus leaving the field with little chance to redeem itself in the eyes of the jaded medical student.

Some have proposed mandatory universal pathology rotations for all medical students to help solve the problem, convinced that exposure during the clinical years would help sway more students into the field.[13] Others have encouraged members of the pathology community to reach out to medical students and deliver propathology content in a career presentation.[14]

Although pathology serves as the basis for the study of medicine, the need for students to learn pathology is not adequately discussed in the literature.[15,16] To our knowledge, no studies have been conducted to determine if these suggested interventions are effective. We directed our efforts to assess medical student attitudes about the field of pathology before and after applied interventions in an effort to gain potential insight into enhancing student interest in pathology as a career.

METHODS

Study Design and Setting

This is a prospective, multicenter study that received approval by the institutional review board. It was conducted as a pilot study at New York Medical College School of Medicine in Valhalla, New York, and the University of South Florida School of Medicine in Tampa between July 2019 and March 2020.

Population

Eligible subjects included first- through fourth-year medical students from New York Medical College and third- and fourth-year medical students from the University of South Florida. The students voluntarily answered the survey anonymously.

Intervention

All individuals in this study were asked if they had rotated through or spent significant time in a pathology laboratory or pathology department beforehand. An anonymous, 2-part survey was given to the first- and second-year medical students at one institution before and after they listened to a 10-minute pathology career presentation and to third- and fourth-year medical students before and after a 4-week pathology elective at the same institution. In the first part of the survey, students responded to 4 questions, using a 10-point scale, that focused on (1) students' interest in pathology as a career, (2) students' interest in a pathology rotation, (3) students' familiarity with the daily responsibilities of practicing pathologists, and (4) how much time (as a percentage) the respondent thought pathologists spend performing autopsies (Table 1). In the second part of the survey, using a 4-point scale (0 = no answer; A = not applicable; B = somewhat applicable; C = applicable), subjects were asked how applicable the following descriptors were to the field of pathology and physicians working as pathologists: innovative, old-fashioned, boring, challenging, exciting, disinteresting, easy, difficult, limited opportunities, expanded opportunities, personable, creepy, socially rejected, popular, cool, intelligent, uncool, happy, disgruntled, satisfied with their work, unsatisfied with their work.

Table 1. Survey Delivered Before and After the Intervention

1. How interested are you in a career in pathology and laboratory medicine (1–10)?
2. How interested are you in completing a pathology and laboratory medicine elective rotation (1–10)?
3. How familiar are you with the daily job responsibilities of pathologists (1–10)?
4. On a scale of 0%–100% as a measure of time, how much time during a given day would you estimate that pathologists participate in performing or interpreting results from autopsy?

Statistical Analysis

Descriptive analyses are presented as frequency and percentage of categorical variables, and as median if numerical. The Fisher exact test was applied to assess distributions for the categorical variable. The differences between numerical variables were calculated using the Wilcoxon rank-sum test when we compared the total of students grouped by preintervention and postintervention as well as when we compared first- versus second-year and third- versus fourth-year students. The Kruskal-Wallis test was used to compare the 4 classes of students (first, second, third, and fourth year). The Dunn test was conducted as a post hoc test for pairwise comparisons. Results were considered statistically significant at a (2-tailed) P value of $< .05$. All statistical analyses were completed using R version 4.0.2 (2020-06-22).

RESULTS

Analysis of All Medical Students

A total of 121 and 83 students responded to the survey before and after the intervention, respectively (Table 2). Of the 121 students who responded to the survey before the intervention, 106 (87.6%) had not spent significant time in a pathology laboratory. Among the 106 individuals who had not had prior contact with the specialty, 82 (77.4%) were from the first and second year (Figure 1).

Table 2. Frequency and Percentage of All Medical Students Enrolled in the Study, by Year

Year	No.	%
First		
Preintervention	47	23.04
Postintervention	46	22.55
Second		
Preintervention	43	21.08
Postintervention	5	2.45
Third		
Preintervention	24	11.76
Postintervention	26	12.75
Fourth		
Preintervention	7	3.43
Postintervention	6	2.94
Total	204	100

Table 3. Median Scores of Questions Delivered Before and After the Intervention, Considering the Pooled Data From First Through Fourth Year

Question	Preintervention	Postintervention	*P* Value
1, 1–10 scale	2	4	<.001
2, 1–10 scale	3	5	<.001
3, 1–10 scale	4	6	<.001
4, %	40	30	.44

There was a significant difference in the median regarding questions 1 through 3 before and after application of the intervention, considering the pooled data from first- through fourth-year students (Table 3).

Stratification by Type of Intervention

As mentioned above, first- and second-year students underwent the same intervention (presentation). Likewise, third- and fourth-year students were surveyed before and after a 4-week pathology rotation. We compared scores of presentation versus 4-week rotation groups before and after the intervention. Students who underwent the presentation (pooled data of first- and second-year students) did not differ regarding the scores to students who underwent the rotation (pooled data of third- and fourth-year students) in the majority of the questions (Table 4).

Stratification by Class

An analysis of questions 1, 2, and 3 yielded significant variation preintervention and postintervention among the different classes ($P < .001$). Nonetheless, a post hoc Dunn test showed that this variation occurred because of a comparison of any class with the fourth-year medical students on questions 1 and 2 ($P < .001$). On question 3, the significant difference occurred only between second- and fourth-year and between third- and fourth-year students ($P < .001$). The remaining comparisons, including among all classes on question 4, did not demonstrate a statistically significant difference (Figures 2 through 5).

Analysis of the Second Part of the Survey

Regarding the second part of the survey, there was a significant difference in most of the answers preintervention and postintervention (Tables 5 and 6). Considering the total of positive descriptors (innovative, exciting, expanded opportunities, personable, popular, cool, intelligent, happy, satisfied with their work) and negative descriptors (old-fashioned, boring, challenging, disinteresting, easy, difficult, limited opportunities, creepy, socially rejected, unintelligent, uncool, disgruntled, unsatisfied with their work), we observed an overall significant difference before versus after the intervention. The detailed findings of the descriptors are shown in Tables 5 and 6.

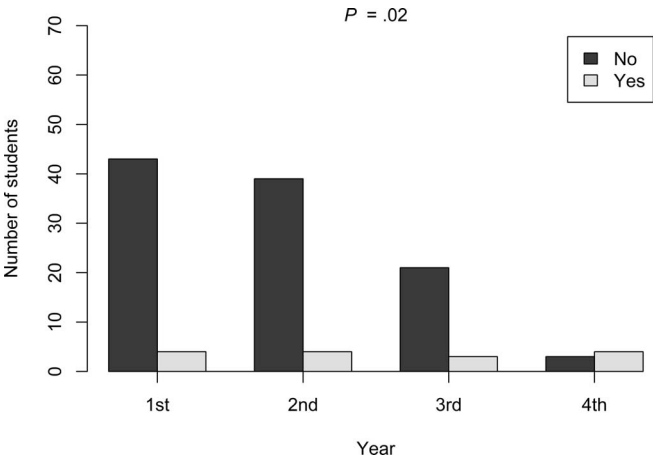


Figure 1. *Comparison among classes on previous rotation or experience with significant time in a pathology laboratory before the intervention.*

DISCUSSION

The decreased medical student interest in pathology as a career as well as the reasons for this have been reported by some authors.[9,15] Curricula at medical schools have evolved significantly in the last decade, with more competency-based and integrative programs. Such changes have impacted pathology as a component of the medical curriculum.[4–7] Although many medical schools now have integrated preclinical curricula, such curricula do not expose students to the routine practice of pathology in patient care. In these curricula, pathology/laboratory medicine learning objectives are carried out in the preclinical years of medical school, and learning objectives are developed from cases with pathology and laboratory data.[3,15–17] In this way, pathology rotations are not routinely included as standard components of the clinical curricula.

Furthermore, the focus of pathology education in most schools is almost exclusively on anatomic pathology.[17] Clinical pathology with relevant visual findings, such as peripheral blood smears, Gram stains, and gels from serum protein electrophoresis, may occasionally be included during the learning experience.[17] However, this approach to medical student teaching of laboratory medicine completely omits tests that generate numbers but no visual pattern.[17] These tests are often not tied to the field of pathology and to what pathologists do, with a mistaken belief that this is a field of PhDs. This not only impacts the conception about the range of pathology as a specialty but also fails to educate future clinicians to order proper diagnostic tests and to interpret the results.[17,18] Novel approaches for better integration of laboratory medicine are needed.[4,9]

Table 4. Median Scores of Questions Delivered Before and After the Intervention for Presentation Versus Rotation Groups

	Preintervention			Postintervention		
Question	Presentation	Rotation	*P* Value	Presentation	Rotation	*P* Value
1, 1–10 scale	2	3	.25	4	3	.12
2, 1–10 scale	3	5	.04	5	6.5	.01
3, 1–10 scale	3.5	4	.89	6	7	.29
4, %	40	30	.29	30	25	.04

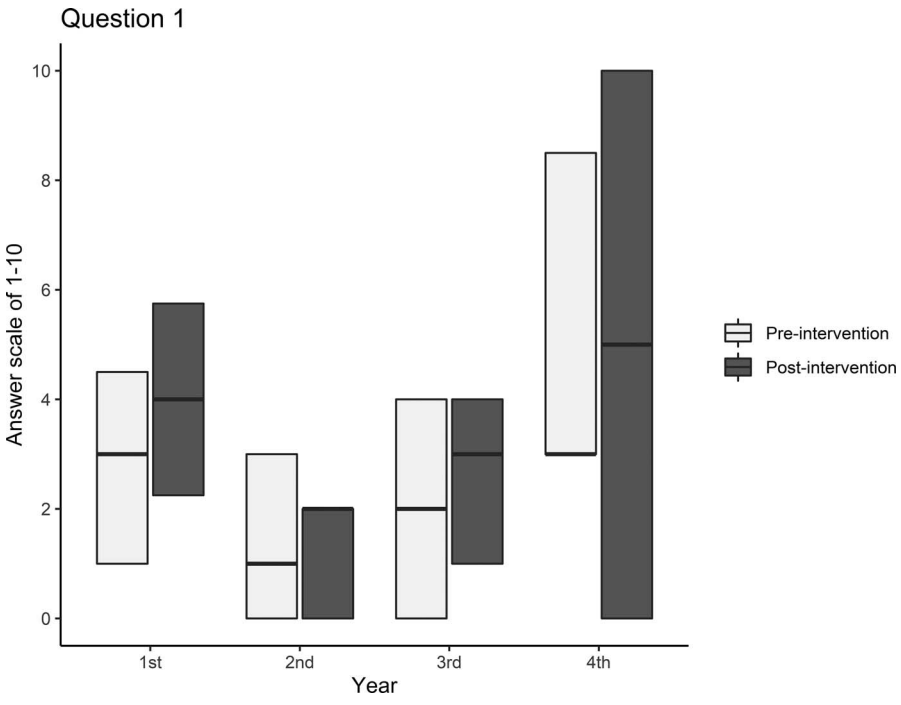


Figure 2. *Comparison among classes on question 1.*

Another challenge is the introduction of condensed postgraduate medical courses and limited time devoted to the discipline of pathology. As medical knowledge continues to increase exponentially, time constraints on undergraduate medical education pose a significant educational challenge. The commendable desire to improve practitioners' communication and ethical skills has been accompanied by a de-emphasis on the understanding of disease mechanisms, and pathology content has declined in the medical curriculum.[3–5,19] Therefore, this current education trend, also known as student-centered curriculum, a problem-based learning and/or case-based learning approach, has contributed to the decreased interest for pathology as a career.[3,4,15–17,19]

Perhaps students go into medical school with a preconceived idea of what field they want to pursue, and this underlies even poorer exposure to pathology in undergraduate education, as indeed our data show that the majority of students in their first year reported no prior exposure to the field (Figure 1). Interestingly, even though the majority of first-year students reported no prior exposure to the field, they still reported opinions (both positive and negative) regarding pathologists and the field of pathology. This suggests that influences outside of the medical community,

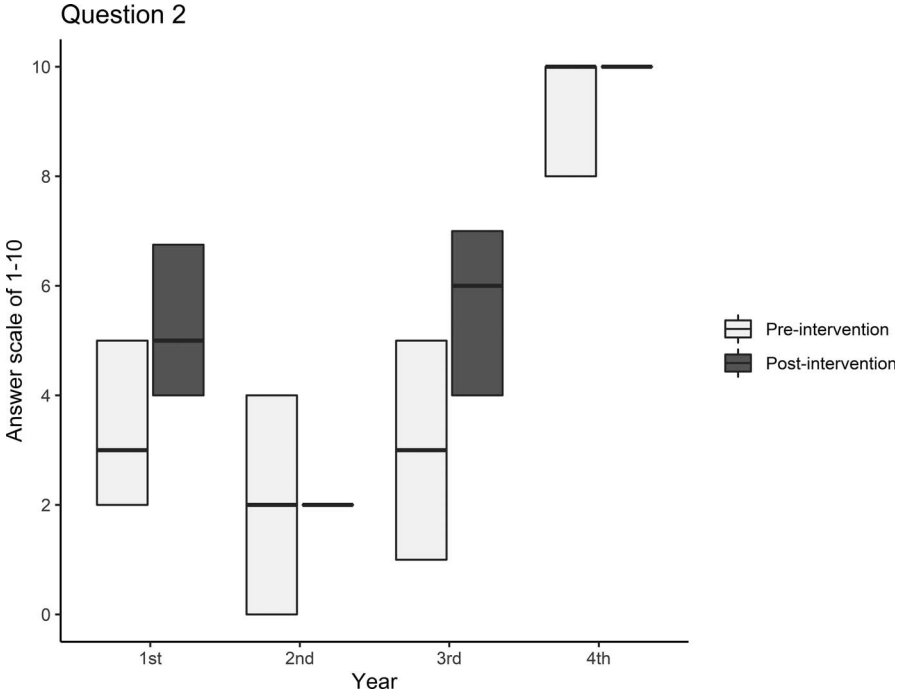
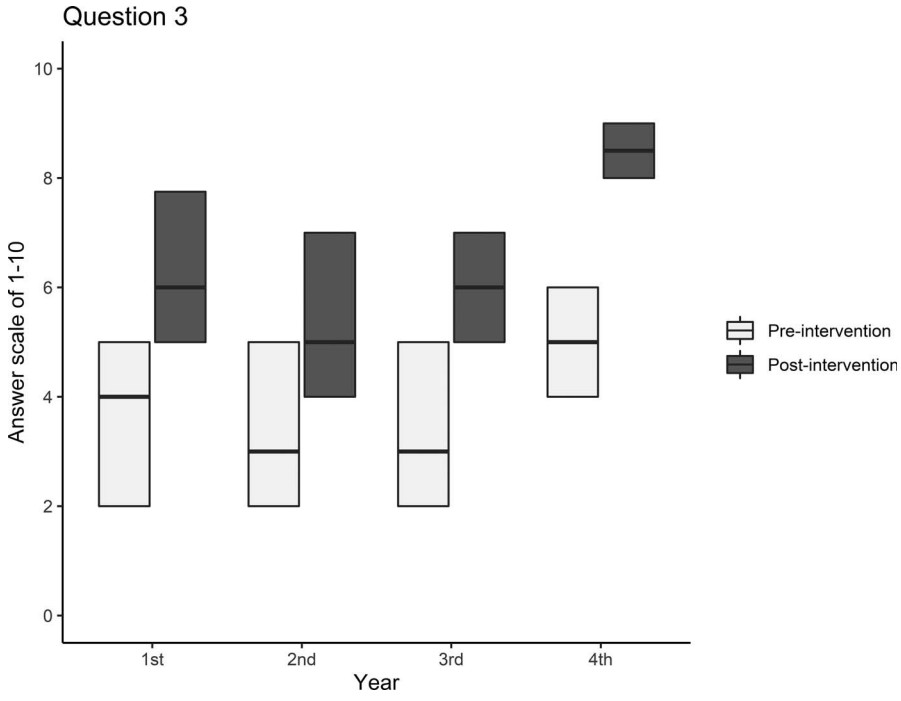


Figure 3. *Comparison among classes on question 2.*

Figure 4. *Comparison among classes on question 3.*



such as depictions in the media, perhaps are contributing to physician specialty choice.

Increasing age of graduates and student debt at graduation from medical school have pushed medical graduates into selecting their areas of practice earlier in their training, and current trends in medical education have leaned toward minimizing training duration.[4] Consequently, a deleterious cycle has been created in which students who are not exposed to the value and importance of pathology in the understanding of disease during their training become practicing physicians who do not entirely appreciate the value of pathology in clinical practice.[4] This problem, compounded by the frequent relegation of pathology to isolated buildings at the periphery of hospitals (or even off-campus sites), results in practicing clinicians who may not fully value the importance of pathology as a discipline, despite using the service on a daily basis in the care of their patients.[4]

Notwithstanding that some authors have reported a stable job market in the field of pathology and even a positive trend in the workforce for pathologists looking for their first nonfellowship position, concerns about employability have also taken place in the context of the unproved although pervasive idea of medical students, and even their advisors,

Figure 5. *Comparison among classes on question 4.*

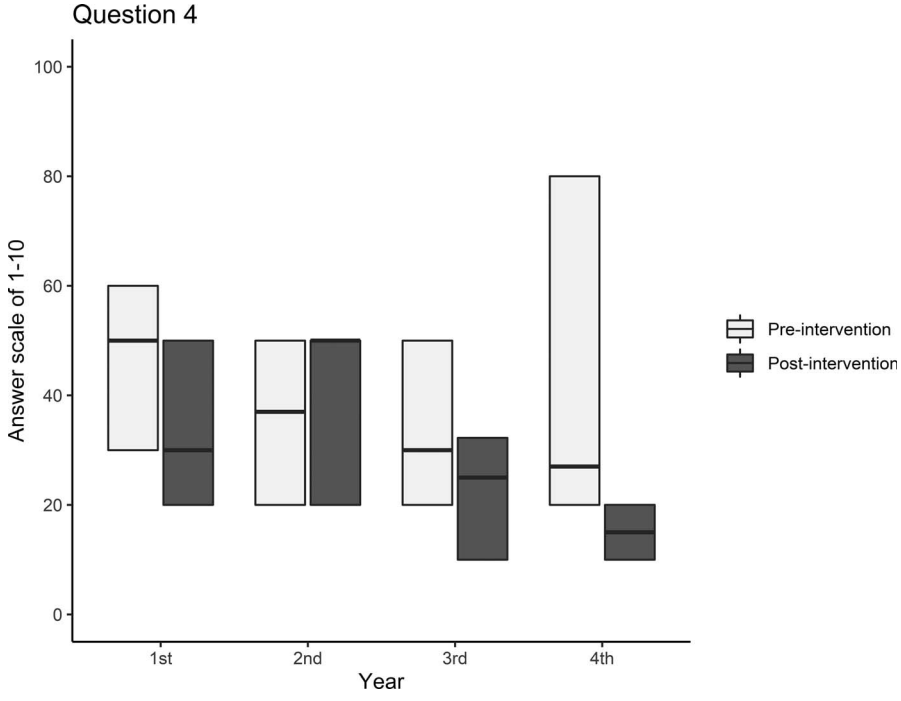


Table 5. Descriptors Preintervention and Postintervention About Pathology According to Medical Students From First Through Fourth Year

Descriptor	Preintervention (n = 121)	Postintervention (n = 83)	*P* Value
Innovative, No. (%)[a]	Applicable, 59 (48.76)	Applicable, 68 (81.93)	<.001
Exciting, No. (%)[a]	Somewhat applicable, 56 (46.28)	Applicable, 43 (51.81)	<.001
Expanded opportunities, No. (%)[a]	Somewhat applicable, 63 (52.07)	Applicable, 54 (65.06)	<.001
Old-fashioned, No. (%)[b]	Somewhat applicable, 52 (42.98)	Not applicable, 55 (66.27)	.001
Boring, No. (%)[b]	Somewhat applicable, 60 (49.59)	Not applicable, 55 (66.27)	<.001
Challenging, No. (%)[b]	Applicable, 87 (71.90)	Applicable, 67 (80.72)	.59
Disinteresting, No. (%)[b]	Somewhat applicable, 54 (44.63)	Not applicable, 62 (74.70)	<.001
Easy, No. (%)[b]	Not applicable, 98 (80.99)	Not applicable, 68 (81.93)	.88
Difficult, No. (%)[b]	Applicable, 61 (50.41)	Applicable, 40 (48.19)	.92
Limited opportunities, No. (%)[b]	Not applicable, 58 (47.93)	Not applicable, 59 (71.08)	.007

[a] Positive descriptors.
[b] Negative descriptors.

that job opportunities for pathologists have decreased.[20,21] Among the 121 individuals who answered the survey before the intervention, 58 (47.93%) believed that limited opportunities in the field of pathology were not applicable. In contrast, of the 83 students who provided responses after the intervention, 59 (71.08%) answered that limited opportunities were not applicable to pathology ($P = .007$). Similarly, there was an improvement regarding the descriptor expanded opportunities, from 63 of 121 (52.07%) answering somewhat applicable to 54 of 83 (65.06%) responding that expanded opportunities is a descriptor applicable to pathology ($P < .001$).

Many articles propose various interventions to recruit more people into a career in pathology. The way pathology is taught is essential, as it influences students' views of the field and what they retain.[15] Talaulikar et al[22] proposed a model of a 2-hour laboratory practical involving bench work followed by case discussion to integrate laboratory results with clinical management. Molinaro et al[23] proposed a 1.5-day panel discussion, designed to introduce the laboratory as a multidisciplinary entity, that showed improvement in laboratory knowledge. Finally, other authors[16,24] have stated that teaching practical pathology, information technology, and virtual education may be as effective as conventional methods; however, further studies would be needed to confirm the obtained results.

The interventions performed in this study provided students with more information about the specialty. The result was a remarkable improvement in students considering pathology as a potential area of specialization. We could observe that during the first 2 years of medical school training, the interest in the specialty was the lowest, and after the experiment, the perception about pathology changed significantly ($P < .001$). Therefore, thoughtful timing of the interventions may be beneficial.

Although interventions are proposed in the literature, this was the first study to have attempted to measure the suggested recruitment strategies' effectiveness. This pilot study was planned to be the first part of a more extensive, multi-institutional study wherein we would measure the effect of applied interventions and document the changes in attitude about the field of pathology in medical students. Unfortunately, the study was stopped prematurely because of changes in the medical education structure caused by the coronavirus disease 2019 (COVID-19) pandemic, making the study intervention analysis impossible to continue. Nonetheless, it may be suggested as a starting point for further projects through the program directors sections of the Association of Pathology Chairs and the Association of Pathology Chairs Pipeline groups. Rotations in diagnostic medicine, which would include pathology and radiology as

Table 6. Descriptors Preintervention and Postintervention About Physicians Working as Pathologists According to Medical Students From First Through Fourth Year

Feature	Preintervention (n = 121)	Postintervention (n = 83)	*P* Value
Personable, No. (%)[a]	Somewhat applicable, 60 (49.59)	Applicable, 62 (74.70)	<.001
Popular, No. (%)[a]	Somewhat applicable, 71 (58.68)	Somewhat applicable, 50 (60.24)	<.001
Cool, No. (%)[a]	Somewhat applicable, 67 (55.37)	Applicable, 40 (48.19)	<.001
Intelligent, No. (%)[a]	Applicable, 102 (84.30)	Applicable, 75 (90.36)	.52
Happy, No. (%)[a]	Somewhat applicable, 64 (52.89)	Applicable, 63 (75.90)	<.001
Satisfied with their work, No. (%)[a]	Applicable, 68 (56.20)	Applicable, 67 (80.72)	.001
Creepy, No. (%)[b]	Not applicable, 88 (72.73)	Not applicable, 76 (91.57)	.005
Socially rejected, No. (%)[b]	Not applicable, 84 (69.42)	Not applicable, 73 (87.95)	.006
Unintelligent, No. (%)[b]	Not applicable, 111 (91.74)	Not applicable, 81 (97.59)	.21
Uncool, No. (%)[b]	Not applicable, 79 (65.29)	Not applicable, 68 (81.93)	.05
Disgruntled, No. (%)[b]	Not applicable, 64 (52.89)	Not applicable, 69 (83.13)	<.001
Unsatisfied with their work, No. (%)[b]	Not applicable, 72 (59.50)	Not applicable, 69 (83.13)	.002

[a] Positive descriptors.
[b] Negative descriptors.

part of an introductory rotation prior to starting clinical rotations, would be beneficial.

This study has some limitations. Despite the statistically significant findings, the small sample size and the limited number of participating institutions could impair generalization. In addition, some students who participated in the first part of the study did not answer the survey post-intervention, and possibly making the survey mandatory would have mitigated this problem. The distribution of classes was not uniform between the 2 participating medical schools. Finally, the experiment was limited in time, and long-term follow-up would be warranted.

CONCLUSIONS

Our study suggests that pathology exposure strategies can have a beneficial effect on student perceptions of the field and considerations for a career in pathology. The students expressed increased confidence that they understood what pathologists do on a daily basis after both interventions. Overall, the presentation intervention seemed to have the greatest effect on increasing student understanding of the daily job responsibilities of pathologists and generating greater interest in pursuing pathology as a potential career. A larger sample size and additional contributions from multiple institutions with various recruitment strategies would enhance our assessment.

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