THE PATH(OLOGY) LESS CHOSEN: EXPLORING MEDICAL STUDENTS' PERCEPTIONS OF ANATOMICAL PATHOLOGY

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ABSTRACT

Anatomical pathologists have been described as medicine's endangered species. The declining interest in anatomical pathology may be attributed to decreased time dedicated to undergraduate pathology teaching. In 2018, a laboratory practical session (LPS) was introduced to the undergraduate medical curriculum at the University of the Free State (UFS]), allowing students the opportunity to gain practical exposure to the discipline. The aim of this study was to investigate whether the LPS highlighted the role of anatomical pathologists in healthcare and encouraged consideration of a career in anatomical pathology. A before-and-after study was conducted among the 2021 cohort of 192 second-year medical students, of whom 176 (91.7%) participated in the survey. Questionnaires were administered before and after the LPS and participants' responses were compared. A statistically significant improvement was observed in students' understanding of the role of anatomical pathologists in healthcare following the LPS (p<0.0001). The LPS contributed to a 10.8 per cent (n=19) increase in the number of participants considering a career in anatomical pathology. Although the LPS improved students' comprehension of anatomical pathologists' role in a healthcare environment, it remains to be seen whether the success of the activity will result in increased applications for registrar positions in future (from approximately 2028/2029 for the 2021 group who participated in the survey). Only then will it be possible to ascertain from the new applicants whether the LPS experience contributed to their decision to specialise in anatomical pathology.

Keywords: anatomical pathology; laboratory; medical students; perceptions; practical; undergraduate

INTRODUCTION

Since the 1990s, a reduction in the time spent teaching pathology in the medical curriculum has resulted in a decrease in the pathologist workforce (Lam, Veitch and Hays 2005). Anatomical pathologists have even been described as "medicine's endangered species" (Graves 2007, S28). The 2010 Carnegie Report resulted in several reforms in the undergraduate medical school curriculum (Irby, Cooke and O'Brien 2010), including a shift from a traditional subject-based to a systems-based approach, with less emphasis on core scientific principles (Chu, Mitchell and Mata 2017). Consequently, the amount of time that medical students engage with certain subjects, in particular pathology, decreased (Damjanov, Perry and Perry 2022).

In South Africa, exposure to pathology in the undergraduate medical curriculum varies between universities. At the University of the Free State (UFS) in Bloemfontein, South Africa, the Department of Anatomical Pathology presents a one-semester basic pathology module, Mechanisms of Disease (MDIS), comprising 16 three-hour lecture sessions, six tutorials in the anatomical pathology museum and ten tutorials in a lecture hall. Passing the MDIS module is compulsory to write the Integrated Medical Assessment Module (MIMA) exams. However, students can still pass the MIMA while failing the anatomical pathology component. Additional to the MDIS module, one to four pathology lectures are presented in each of the system-specific modules. Again, students are not required to pass the pathology component of the systems modules' assessments.

Since the de-emphasis of dedicated pathology courses, students tend to believe that pathologists are basic scientists with limited career options (Xu 2011; Zafar and Baccon 2018). Literature related to perceptions of pathology is disheartening, with pathologists perceived to work "behind the paraffin curtain" (Uthman 2014, 12) and some authors encouraging pathologists to "emerge from the basement" (Harrold, Bean and Williams 2019, 917). Pathologists appear to be invisible in patient care (Gardner 2017; Montironi, Cimadamore and Scarpelli 2020; Xu 2011), as they are located in isolated buildings on hospital premises and are not physically present in the multidisciplinary patient care team, for example, on ward rounds or in operating theatres (Montironi et al. 2020). Anatomical pathologists spend countless hours behind a microscope, perfecting the art of formulating diagnoses while examining "50 shades of blue and pink" (Matsika and Srinivasan 2012, 668), resulting in pathologists being perceived as technicians (Hung, Jarvis-Selinger and Ford 2011; Matsika and Srinivasan 2012).

The decreasing interest in anatomical pathology is a worldwide crisis (Chorneyko and Butany 2008; Graves 2007), with only 1–3 per cent of medical graduates applying to specialise in anatomical pathology (Hung et al. 2011). This could be attributed to several factors. Ford (2010) found that medical students who prefer regular patient contact, or those who have a pre-existing preference for another specific medical field, are unlikely to be recruitable into pathology. A pertinent comment by a respondent in Ford's study was that they "went into medicine to work with people, not specimens." Respondents also commented that they had "never [encountered] a live pathologist in hospital while in medical school," and that pathology seems more like a "technician job" (Ford 2010, 569–570). These comments emphasise the importance of promoting pathologists' visibility within the hospital to successfully entice more medical students to consider pathology as a career. Furthermore, not only does this lack of visibility have a negative impact on the recruitment of medical students into pathology as a career; it also results in clinicians being insufficiently equipped to appropriately use pathology services in practice (Holloman et al. 2023).

Often, medical professionals' only exposure to the pathology disciplines is during their undergraduate training (Ford 2010; Minhas et al. 2017). Pathologists should seize these limited opportunities to showcase their profession. Ford even suggested that pathologists should attempt to be more positive and enthusiastic when engaging with medical students (Ford 2010).

Pathology rotations often lack emphasis on skill building (Hung et al. 2011). Encouraging a practical approach, such as fine-needle aspiration workshops or specimen cutting demonstrations, could leave lasting impressions (Harrold et al. 2019). Although students might prefer a traditional lecture-based method of learning pathology, a hands-on, active learning approach could be more beneficial (Al Nemer 2020).

In 2018, an additional compulsory laboratory practical session (LPS) was included in the MDIS module during which undergraduate medical students visit the anatomical pathology laboratory. The visit entails showing students how to complete a pathology request form correctly and go through the process of specimen reception, grossing, processing, cutting and staining of slides. Students are also encouraged to voluntarily attend a postmortem examination during their free time. Second-year medical students registered at the UFS in 2021 that were included in the study are henceforth referred to as participants.

The aim of the study was to investigate the perceptions of participants regarding anatomical pathology and whether the LPS improved their understanding of and interest in the discipline. The objectives were to (i) investigate whether participants understood the role of anatomical pathologists in patient care; (ii) determine whether participants would consider

anatomical pathology as a career; and (iii) investigate whether their perceptions towards pathology were influenced by the LPS.

METHODS

Study participants

The study comprised 192 second-year undergraduate medical students registered at the UFS in 2021. Informed consent was obtained prior to enrolment in the study. Participation was voluntary and personal details remained confidential. Small groups of approximately 13 participants per group were allocated a specific day and time to visit the laboratory as part of their MDIS module.

Measurement

A before-and-after study was performed. Two identical, self-administered questionnaires were completed, the "before" questionnaire upon arrival at the laboratory, and the "after" questionnaire immediately following the LPS. The questionnaire was adapted from a previously published study (Al Nemer 2020). A pilot study on ten randomly selected fourth-year medical students was performed to validate the questionnaire. No alterations were required and the pilot study results were not included in the final analysis.

Laboratory practical session (LPS) program

Fourteen one-hour sessions were conducted over three days. To avoid bias, all 14 sessions were presented by the principal investigator. The LPS was conducted in the Department of Anatomical Pathology seminar room and the histopathology laboratory, and covered the topics described below.

Introduction to the laboratory and laboratory safety

An interactive PowerPoint presentation orientated participants to the laboratory and highlighted safety guidelines before they were permitted to enter the histopathology laboratory.

The role of anatomical pathologists in patient care

Participants engaged in an interactive discussion facilitated by the PowerPoint presentation. The presentation highlighted the role of anatomical pathologists in patient care. Topics discussed included:

- qualifications anatomical pathologists are required to obtain;
- the differences between anatomical and forensic pathologists;
- where one could find an anatomical pathologist in the hospital setting;
- the role anatomical pathologists play in patient management;
- the importance of providing an accurate clinical history to anatomical pathologists; and
- types of specimens received for evaluation by anatomical pathologists.

How to correctly complete a pathology request form and what fixative to use when submitting specimens

Each participant was given a blank laboratory request form to familiarise themselves with the requirements necessary to submit a specimen to the histopathology laboratory. They were also informed about the importance of submitting specimens for histology in formalin.

Cut-up of specimens

Participants viewed a live demonstration of the cut-up of a large specimen. The principal investigator described the macroscopy of the specimen and demonstrated sectioning of the tissue. Large specimens included hysterectomy specimens and placentas. Interesting cases scheduled as part of the workflow on the day of their LPS were presented, for example, teratomas, myomatous uteri and ruptured ectopic pregnancies.

Specimen processing

Following the cut-up demonstration, participants were taken on a guided tour of the laboratory, reiterating what was shown in the PowerPoint presentation.

Exclusion criteria

Students who did not provide consent for participation were excluded from the study. Participants who failed to submit both the "before" and "after" questionnaires or arrived late for the LPS were also excluded.

Statistical analysis

Data were captured on an Excel spreadsheet and submitted to the Department of Biostatistics, UFS, for statistical analysis using SAS, version 9.4 (SAS Institute Inc.; Cary, NC). Continuous variables were summarised by medians and percentiles and categorical variables by frequencies

and percentages. Differences between the participants' before and after responses were evaluated using appropriate statistical tests for paired data.

Ethical considerations

The study was approved by the Health Sciences Research Ethics Committee approval (UFS-HSD2020/1913/2601) of the University of the Free State. All second-year medical students were enrolled for this study if they consented to participate. Voluntary participation and completion of both questionnaires implied informed consent.

RESULTS

Demographic variables

In total, 176 (91.7%) of the 192 second-year students participated in the study, of whom 105 (60.0%) were female. The median age was 20 years (range 17–40 years).

Role of anatomical pathologists in healthcare

The percentage of correct answers to the question pertaining to the role of anatomical pathologists in healthcare increased significantly after the LPS ($p<0.0001$) (Figure 1). The only question showing no statistically significant similarity ($p=0.6444$) in participants' responses was: "Do anatomical pathologists play an important role in diagnosing disease?" Before the LPS, 172 (97.7%) participants indicated that this was correct, which increased to 99.4 per cent (n=175) afterwards.

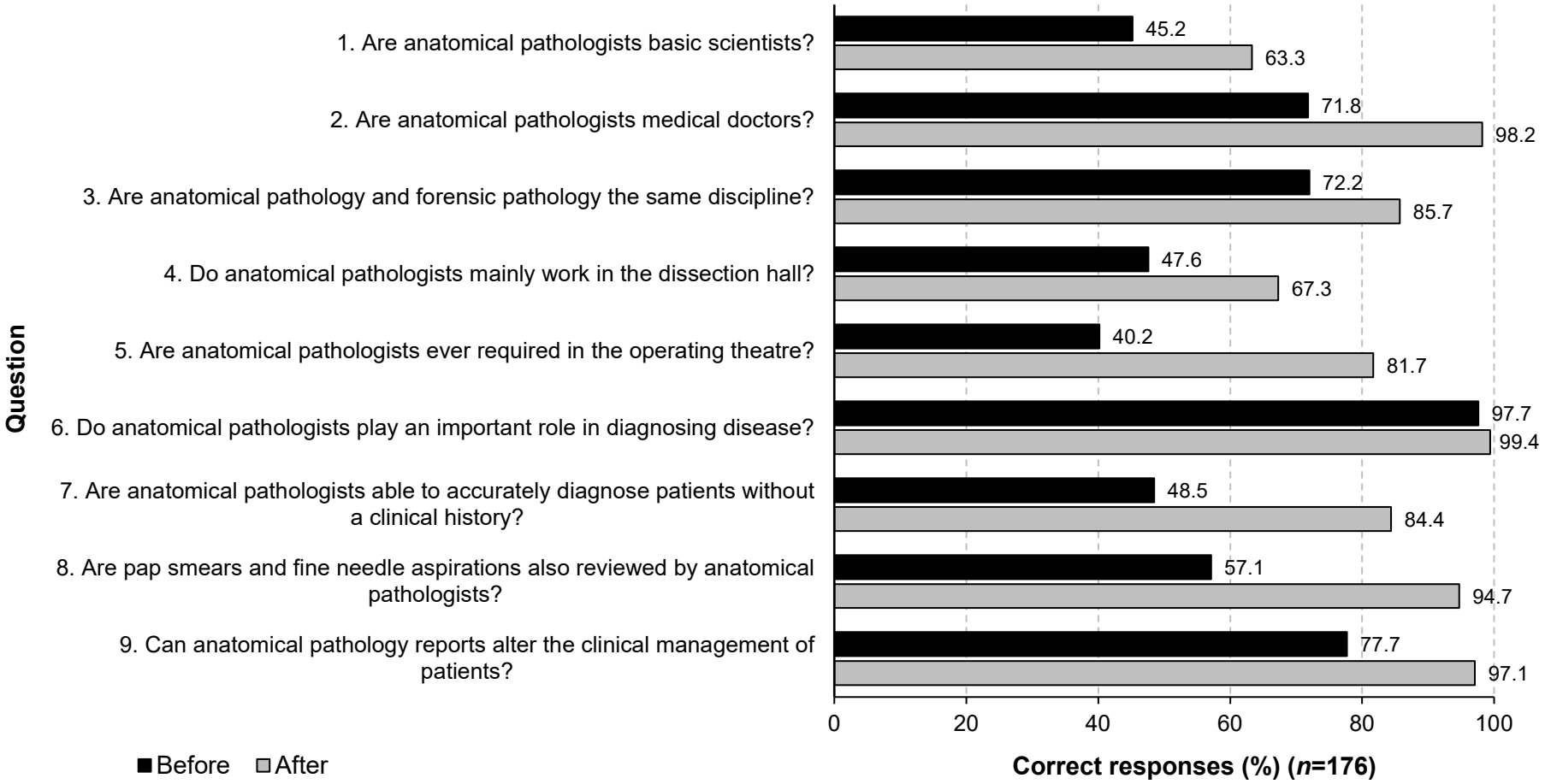

Figure 1. Percentage correct responses regarding the role of anatomical pathologists in healthcare before and after the laboratory practical session (LPS.

Pathology as a career

Before the LPS, 56 (31.8%) participants would consider a career in anatomical pathology, which increased to 76 (43.2%) participants after the LPS. Ten (17.5%) participants who were not considering a career in anatomical pathology were willing to consider it after the LPS (Table 1).

Table 1. Before and after the laboratory practical session (LPS) comparison matrix for questions "Would you consider a career in anatomical pathology?" and "Do you have a preferred speciality?"

		WOULD YOU CONSIDER A CAREER IN ANATOMICAL PATHOLOGY?				
		After LPS				
		Yes	**No**	**I don't know**	**Omitted**	**TOTAL**
		***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Before LPS	**Yes**	41 (73.2)	5 (8.9)	4 (7.1)	6 (10.2)	56 (31.8)
	No	10 (17.5)	35 (61.4)	6 (10.5)	6 (10.5)	57 (32.4)
	I don't know	23 (38.3)	13 (21.7)	22 (36.7)	2 (3.3)	60 (34.1)
	Omitted	1 (33.3)	1 (33.3)	0 (0)	1 (33.3)	3 (1.7)
	TOTAL	75 (42.6)	54 (30.9)	32 (18.2)	15 (8.5)	176 (100)
		DO YOU HAVE A PREFERRED SPECIALITY?				
		After LPS				
		Yes	**No**	**I don't know**	**Omitted**	**TOTAL**
		***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**	***n* (%)**
Before LPS	**Yes**	90 (84.9)	0 (0)	3 (2.8)	13 (12.3)	106 (60.2)
	No	1 (2.5)	35 (87.5)	1 (2.5)	3 (7.5)	40 (22.7)
	I don't know	1 (4.0)	8 (32.0)	14 (56.0)	2 (8.0)	25 (14.2)
	Omitted	1 (20.0)	1 (20.0)	1 (20.0)	2 (40.0)	5 (2.8)
	TOTAL	93 (52.8)	44 (25.0)	19 (10.8)	20 (11.4)	176 (100)

Before the LPS, 106 (60.2%) participants had a preferred speciality, 40 (22.7%) did not and 25 (14.2%) were unsure about a preferred speciality. Five students (2.8%) did not respond to this question. After the LPS, 90/106 (84.9%) participants who had a preferred speciality before the LPS, still had a preferred speciality (Table 1). Three (2.8%) participants were unsure of their preferred speciality afterwards. One participant indicated pathology (unspecified) as the preferred speciality before the LPS. However, this participant omitted the question pertaining to the preferred speciality afterwards. Two (1.1%) participants chose anatomical pathology as

their preferred speciality after the LPS. It was noteworthy that both these participants considered oncology as their preferred speciality before the LPS.

Reasons for not choosing anatomical pathology as a future career are displayed in Table 2, with many participants already having a preferred speciality in their second year of medical training. Sixty (56.6%) participants indicated that because they already had a preferred speciality, they were not willing to consider a career in anatomical pathology. The top five preferred specialties and reasons for not choosing anatomical pathology as a speciality are listed in order of preference in Table 2.

Table 2. Top five preferred specialities and reasons for not choosing anatomical pathology as a speciality.

Variable	n (%)
Top five preferred specialities (n = 106)	
Unspecified surgery	15 (14.2)
Paediatrics	14 (13.2)
Neurology	9 (8.5)
Cardiology	9 (8.5)
Neurosurgery	7 (6.6)
Reasons for not choosing anatomical pathology as a speciality (n = 176)	
I prefer direct patient contact.	67 (38.1)
I prefer a different speciality.	60 (34.1)
I have had insufficient medical school exposure to pathology.	55 (31.3)
Pathology is boring.	3 (1.7)
Pathology exams are too difficult.	0 (0)

DISCUSSION

Role of anatomical pathologists in healthcare

A statistically significant improvement was observed in participant's knowledge regarding the role of anatomical pathologists after the LPS. Compared to Al Nemer's (2020) findings, with 87 per cent of participants recognising the importance of providing anatomical pathologists with a clinical history and differential diagnosis, only 49 per cent of participants in our study realised this important aspect before the LPS. Afterwards, 85 per cent of participants indicated

that anatomical pathologists could not work in isolation and required clinical information to make accurate diagnoses.

Pathology as a career

The number of participants that would consider a career in anatomical pathology increased by 11.4 per cent after the LPS, showing that this activity could influence students to consider specialising in anatomical pathology. Whether or not this will lead to an increase in registrar applicants in the future remains to be seen. These results are encouraging compared to the findings of Al Nemer (2020), where only 9 per cent of participants would consider a career in anatomical pathology. Fielder et al. (2022) reported even more concerning findings – among 720 Australian medical students and junior doctors, only 1.7 per cent indicated an interest in pursuing a career in anatomical pathology.

In a recent study among 664 medical students in Saudi Arabia, 19.6 per cent indicated that they were interested in pathology, although only 2.9 per cent considered it as their primary career preference. Furthermore, approximately 7 per cent of students attributed their choice of specialty to their own experience during training (Alharbi et al. 2024), emphasising the fact the constructive exposure during undergraduate training might have a positive influence on medical students' future career choice.

One participant stated that he/she was "not sure I would be comfortable dealing with dead bodies." Considering that anatomical pathologists are frequently confronted with cadavers for medical postmortems, this is a valid "anti-pathology" concern. Although anatomical pathologists may regard their career (including conducting postmortem examinations) as "amazing" (Razzano et al. 2020, s.p.), this view is, understandably, not shared by all medical students.

Other reasons centred around the recurring theme of having "insufficient exposure" to anatomical pathology. Comments included that participants were "lacking exposure to any speciality," one stated that they had "never thought about it [anatomical pathology]," while another said they "don't know exactly what anatomical pathology [the career] entails." These comments reiterated previous findings that pathology is not "unloved," it is simply unknown (Mikhael 1993, 1078).

Our results regarding students' preferred speciality before and after the LPS confirmed that students who had a preferred speciality were unlikely to change their minds about their initial choice (Ford 2010). Two (1.1%) participants chose anatomical pathology as their preferred speciality after the LPS. Both students initially indicated oncology as their preferred

speciality, implying that they realised the integration between anatomical pathology and the diagnosis of benign and malignant pathologies. Hung et al. (2011) reported that only 1–3 per cent of medical graduates pursue a career in pathology.

Reasons for not choosing anatomical pathology most commonly related to direct patient contact. Many participants also indicated that they already had a preferred speciality. These opinions have been reported previously as the two most common reasons for medical students not considering anatomical pathology as a career (Al Nemer 2020).

Undeniably, anatomical pathologists at the UFS do not have much direct contact with patients, although it is not the scenario in all medical institutions. Surgical pathology clinics and cytopathology clinics are emerging entities that enhance interaction between pathologists and patients (Manek 2012; Misialek 2013; Shachar et al. 2021). Unless anatomical pathologists become more visible in the hospital setting, it is unlikely that more medical students will consider a career in anatomical pathology.

Most participants in this study, who were in their second year of medical training, already had a preferred speciality. At this stage in the medical curriculum, participants have only been exposed to basic medical sciences, for example, anatomy and biochemistry. However, 55 (31.3%) participants indicated that they would not choose pathology as a future career because of insufficient exposure to pathology. By implication, they had predetermined ideas of their preferred speciality based on pre-medical school exposure. This observation should prompt researchers to promote the awareness and visibility of anatomical pathologists prior to attending medical school. Prospective medical students could possibly be encouraged to engage with anatomical pathologists from as early as high school. Public exhibits and holiday projects offered at high schools and undergraduate institutions have been suggested (Zafar and Baccon 2018).

It could be asked whether medical students endure undue pressure to have a preferred speciality while doing their undergraduate training. In general, participants' preferred specialities stayed the same both before and after the LPS. Of the 106 participants who indicated a preferred speciality, only 25.5 per cent had either changed their minds or omitted this question after the LPS, while only two participants changed their preferred speciality to anatomical pathology following the LPS. Although a change in preference in only 1 per cent of participants may seem relatively inconsequential, it could be reasoned that perhaps participants were not willing to consider a different career path. Pressure on medical students to have preferred specialities and abide by these decisions made early in their training might be a contributing factor (Matsika and Srinivasan 2012; Xu 2011).

Positive feedback was noted in the comments section of the questionnaire. Participants described the LPS as "very interesting" and "very informative." One participant commented that "the work done is amazing." Another participant even expressed the desire to return to see more specimen dissections. Following the LPS, approximately 80 participants contacted the Department of Anatomical Pathology directly and requested to view a medical postmortem. These encouraging outcomes of the LPS emphasise the importance of presenting the LPS in the MDIS module. After the LPS, comments revealed that participants perceived anatomical pathology more positively.

Perceptions of anatomical pathology

Participants raised concerns that the "terminology of pathology is jargon." One participant commented that "we are new to this module language and terms." Educators should take into consideration that English is not the home language of many medical students in South Africa, which has 11 official languages. Anatomical pathologists should not allow language challenges to prevent participants from being passionate about pathology. These findings highlight the possibility of adapting the MDIS module to include a medical terminology session that could encourage participants to gain language skills and confidence in pathology literacy.

Limitations

Some limitations should be addressed to improve the LPS in future. More time should be allocated for the LPS to allow participants the opportunity to engage in hands-on cut-up work. It would be beneficial to host an intensive "pathology boot camp" style LPS or workshop for participants showing interest in anatomical pathology. This format of teaching would focus more intensely on the practical aspects of anatomical pathology.

Time constraints also prevented the LPS from including a slide review session. Reviewing the microscopic features of specimens to identify abnormalities in tissue specimens is fundamental to the everyday activities of anatomical pathologists. Participants would gain more insight into the responsibilities of anatomical pathologists from a slide review session, which should be considered in future planning of the LPS.

RECOMMENDATIONS

Subsequent to this study, modifications to the LPS can be suggested. The LPS is recognised as an important part of the MDIS module and should continue to be presented. Appropriate adjustments, such as increased time allocated to each LPS, should be considered. A slide review session should also be offered to medical students. Considering that many students are not English home-language speakers, including a pathology literacy class to the MDIS module will enable medical students to appreciate the discipline of pathology without undue language barriers.

The visibility of anatomical pathologists in the Faculty of Health Sciences should be addressed and they should consider embarking on the daunting task of integrating into clinical practice. This will allow medical students the opportunity to appreciate the role of anatomical pathologists as valuable members of the multidisciplinary patient care team. The possibility of conducting a fine-needle aspiration clinic or weekend workshop could also be investigated. Should this not be feasible, pathology consultation services for patients wishing to discuss their pathology reports could be considered. Alternatively, anatomical pathologists could consider joining ward rounds to be observed as doctors actively involved in patient care. The UFS Department of Anatomical Pathology could also consider becoming appropriately active on social media, keeping patient anonymity in mind. These recommendations might improve the perceptions that the medical community have towards anatomical pathologists.

CONCLUSION

Adding the LPS to the MDIS module was successful in influencing the perception participants had towards pathology. The structure of the LPS forms a basis for development of other innovative ways to encourage medical students to engage with pathology. The LPS is a valuable educational tool that should continue to be implemented, albeit with minor modifications to the medical curriculum. It also emphasised the importance of exposing undergraduate medical students to the practical aspects of anatomical pathology. This study emphasised the necessity for anatomical pathology modules to relate the discipline to clinical scenarios. To encourage students' interest in the field, anatomical pathologists need to be more visible to medical students. The LPS contributed to a better understanding of the role of anatomical pathologists and allowed participants to experience this fascinating and fulfilling discipline. It remains to be seen whether the increased interest in anatomical pathology will result in a corresponding increase in the number of applications for registrar positions in future (from approximately 2028/2029 for the 2021 group who participated in the survey). Only then

will it be possible to ascertain from the new applicants whether the LPS experience contributed to their decision to specialise in anatomical pathology.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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DATA AVAILABILITY STATEMENT

Data are available from the corresponding author upon reasonable request.

DECLARATION

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