

Relevance and application of histology beyond the preclinical phase: Perception of fourth year medical students in a medical school in Sri Lanka

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Abstract

Objectives: This study aimed to examine the perception of fourth-year medical students regarding the relevance and application of histology knowledge in learning paraclinical sciences and in clinical training.

Methods: A cross-sectional, anonymized online survey was carried out among the fourth-year medical students of Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka.

Results: Survey of 69 students revealed a mean perceived histology knowledge retention of 46.7% after four years. A majority (89.7%) considered histology moderately to extremely relevant to clinical practice. All respondents applied histology in pathology, with most also using it in clinical training in surgery (71%) and medicine (68.1%). Students found histology of epithelia and glands, bone marrow, bone, and lymphoid tissues most relevant among basic histology topics. Histology of gastrointestinal organs, thyroid, breast, vascular system, uterus, tracheobronchial tree, kidneys, and heart were considered highly relevant among system-based histology topics. Students suggested introduction of basic histopathological features of common diseases into the histology curriculum, and providing self-learning resources for revising histology during later stages of the MBBS course.

Conclusions: This study, conducted as an initial step in histology curriculum revision, found most of the students recognized its relevance to paraclinical and clinical learning. The study provided information on content areas that were perceived to have higher relevance. The findings highlight the need for clinical integration of histology with increasing collaboration between preclinical and clinical faculty and emphasizing the histological basis of common diseases.

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Introduction

Histology is a fundamental component of basic sciences in undergraduate medical curricula and has been recognized as a prerequisite for understanding the integrated structure and function of the human body at cellular and tissue levels. Moreover, histology knowledge provides the foundation for understanding the pathological process and thereby assists the diagnosis and treatment-related decision making in clinical practice (1). Despite the recognition of basic biomedical sciences as an essential component of an undergraduate medical curriculum there has been a significant reduction in the time allocated for Anatomy education over the last few decades (2,3). Further, the contribution of histology in the anatomy curriculum and the overall medical programs appears to be declining as observed in a large-scale survey across undergraduate medical courses in the United States (4). Another challenge encountered by anatomy educators in relation to histology teaching is the information overload due to the expansion of knowledge on cellular and tissue architecture provided by advanced histological and microscopic techniques (5). Lack of engagement of the students was observed even in the modern Histology teaching programmes where online or blended learning approaches with online platforms and online teaching-learning material such as virtual microscopy are mostly used (5,6). Moreover, there is an ongoing debate on ‘when to teach histology?’ and ‘who should teach histology?’ in an undergraduate medical course. Another main challenge is the ‘lack of context’ which occurs when histology is taught without clinical context, disintegrated from the histopathology

and other clinical disciplines within the curriculum (5,7).

In the undergraduate medical curriculum of the Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka (FMAS, RUSL), histology is taught during the first three semesters of the program (i.e. ‘Preclinical course’) as an integral component of the Anatomy curriculum. Histology accounts for 10.6% of the total volume of learning in Anatomy (69 out of 650 notional hours in Anatomy). Learning objectives in histology focus on the acquisition of knowledge regarding the microscopic structure of human tissues and organs, and skills in the identification of these microscopic features in optical microscopy. Identification of the need for a revision of the histology curriculum in FMAS, RUSL was at first based on the observations, self-evaluation, and reflection of the existing curriculum and its outcomes. Additionally, a survey among recent graduates of the FMAS, RUSL (pre-interns and intern medical officers) showed that histology is considered less relevant in clinical training and practice compared to other components of the anatomy curriculum, especially, neuroanatomy, radiological anatomy, and macroscopic anatomy of the abdomen and pelvis, and the head and neck regions (8). Formal identification of the need for a revision of histology curriculum arose from this graduate survey, and the recommendations of the program review and accreditation teams from the professional bodies (University Grants Commission of Sri Lanka and the Sri Lanka Medical Council). The international and local guidelines and frameworks such as ‘Basic Medical Education, World Federation

of Medical education Global Standards for Quality Improvement' (9) and Subject Benchmark Statement in Medicine (10) informed the need to include basic biomedical sciences (including histology) to undergraduate medical curricula, for the understanding of clinical sciences and application.

This paper reports the findings of a student's feedback survey conducted among fourth-year medical students of FMAS, RUSL to examine their perception regarding the existing histology curriculum and the relevance and application of histology knowledge in learning during paraclinical and clinical phases of the MBBS program including the clinical training. The study aimed to identify the needs of the senior students of the faculty, as the immediate consumers of the histology curriculum and one of the main stakeholder groups identified for the needs assessment during the initial phase of the curriculum revision process of FMAS, RUSL.

Methods

A cross-sectional study in the form of an online survey was carried out among the fourth-year medical students of FMAS, RUSL. At the time of data collection, the students were at the last month of the fourth year of the MBBS program. By that time, they have completed the pre-professorial clinical training in all major clinical disciplines (i.e. medicine, surgery, pediatrics and obstetrics and gynecology) and related sub-specialties and completed teaching in the Paraclinical phase that include pathology, forensic medicine and

family medicine. Participants were recruited voluntarily via a link to the Google Form, which served as the data collection tool. The first section of the form provided a clear and comprehensive information sheet about the study's purpose, what participation would involve, and how their data would be used. They were then asked to provide informed consent electronically by checking a box before they could proceed with the survey. The participants could withdraw at any point without any penalty by simply not completing the survey. The survey consisted of questions to assess the students' perceptions regarding the existing histology curriculum and the application of histology knowledge in different paraclinical and clinical disciplines. Participants were asked to rate their perceived retention of histology knowledge on a numerical rating scale from 0 to 100. The mean and standard deviation of these ratings were then calculated. They were also asked to rate the different contents in basic histology and systemic-based histology on a scale from 0 ('Not relevant at all') to 5 ('extremely relevant'). Finally they were asked to provide additional comments and suggestions for the improvement of the academic program in histology. The data were analyzed using descriptive statistics. The study was conducted as a feedback survey for curriculum evaluation and review, which was approved and overseen by the Faculty's Quality Assurance Cell. It was conducted as a part of standard quality assurance and curriculum improvement process and did not involve any intervention or sensitive personal data.

Results

The target batch of students included 179 students. Sixty-nine students completed the survey, giving a response rate of 38.5%. The participants were aged between 24 to 27 years. Most of the participants (65.2%) were females.

Perceived retention of histology knowledge

The perceived retention of histology knowledge at the time of data collection (i.e. after 4 years in the MBBS course) ranged between 10 to 80 (on a scale from 0 to 100) with a mean of 46.7 and a standard deviation of 15.3.

Perception regarding the integration, relevance and application of histology knowledge in other disciplines

Perception regarding the overall histology curriculum

Majority of the respondents stated that the histology curriculum is well integrated with the other preclinical disciplines (i.e. biochemistry and physiology) and adequately prepared them for learning paraclinical disciplines and for clinical training (Figure 1). Among the respondents 8.8% and 41.2% felt histology knowledge as ‘extremely relevant’ and ‘very relevant’ to clinical training respectively, while 39.7% of the respondents perceived histology as ‘moderately relevant’ to clinical training (Figure 2).

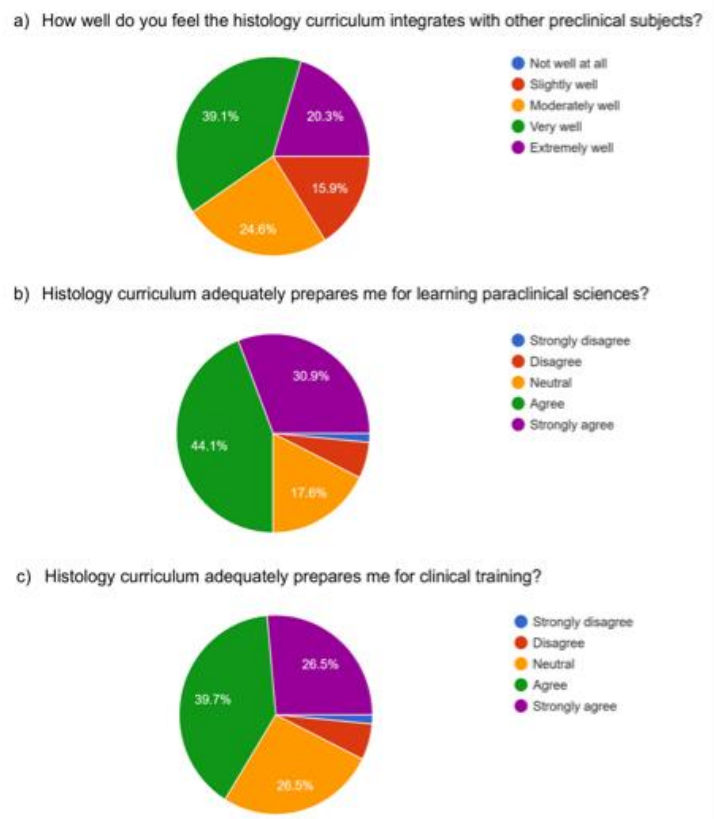


Figure 1: Students’ perception regarding the integration and application of histology with other disciplines of the preclinical and paraclinical courses, and clinical training

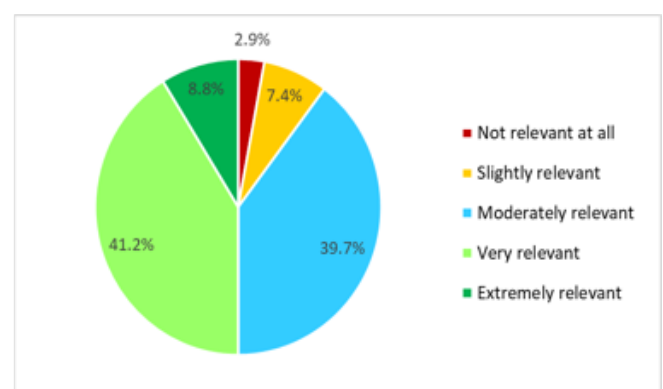


Figure 2: Students’ perception regarding the relevance of histology knowledge in clinical training

All the respondents indicated that they have applied histology knowledge in their learning in pathology. Majority had applied the histology knowledge during the clinical training in surgery and related sub-specialities (71.0%), and in medicine and related sub-specialities (68.1%). Among the respondents, 37.7%, 30.4% and 17.4% stated that they have applied histology knowledge in obstetrics and gynecology, forensic medicine and pediatrics, and the application of histology knowledge in learning other disciplines were minimal (<10%).

Perception regarding the different content areas of the histology curriculum

- *Basic histology*

Curriculum contents of the basic histology course delivered during the semester 1 of the MBBS program of FMAS, RUSL include the epithelia and glands, connective tissues (including loose and dense connective tissues, bone and cartilage), muscles, nerves, lymphoid tissue and the bone marrow. Table 1 present the mean values of the perceived relevance of the content areas of the basic histology course, collected on a scale between 0 to 5, and Figure 3 presents the distribution of the responses. Histology of the epithelia and glands (4.18 ± 0.94), bone marrow (4.16 ± 1.05), bone (4.07 ± 0.90) and lymphoid tissues (4.03 ± 1.09) were perceived more relevant than the other content areas in the basic histology course.

- *System-based histology*

Contents in the system-based histology course were delivered during the first three semesters of the MBBS program of FMAS, RUSL within the respective system-based modules of the Preclinical course. Table 2 present the mean values of the perceived relevance of the content areas of the system-based histology course, collected on a scale between 0 to 5, and Figure 4 presents the distribution of the responses. Histology of the gastrointestinal organs (oesophagus, stomach, intestines and liver), thyroid gland, breast, vascular system, uterus, tracheobronchial tree, kidneys and heart were perceived mostly relevant in their paraclinical learning and clinical training.

Table 1: Perceived relevance and application of different content areas in Basic histology (rated on scale between 0-5)

Content area	Mean ($\pm$ SD)
Epithelia and glands	4.18 ($\pm$ 0.94)
Loose connective tissue	3.67 ($\pm$ 1.21)
Dense connective tissue	3.56 ($\pm$ 1.17)
Bone	4.07 ($\pm$ 0.90)
Cartilage	3.67 ($\pm$ 1.11)
Muscles	3.92 ($\pm$ 1.10)
Nerve tissue	3.87 ($\pm$ 1.16)
Lymphoid tissue	4.03 ($\pm$ 1.09)
Bone marrow	4.16 ($\pm$ 1.07)

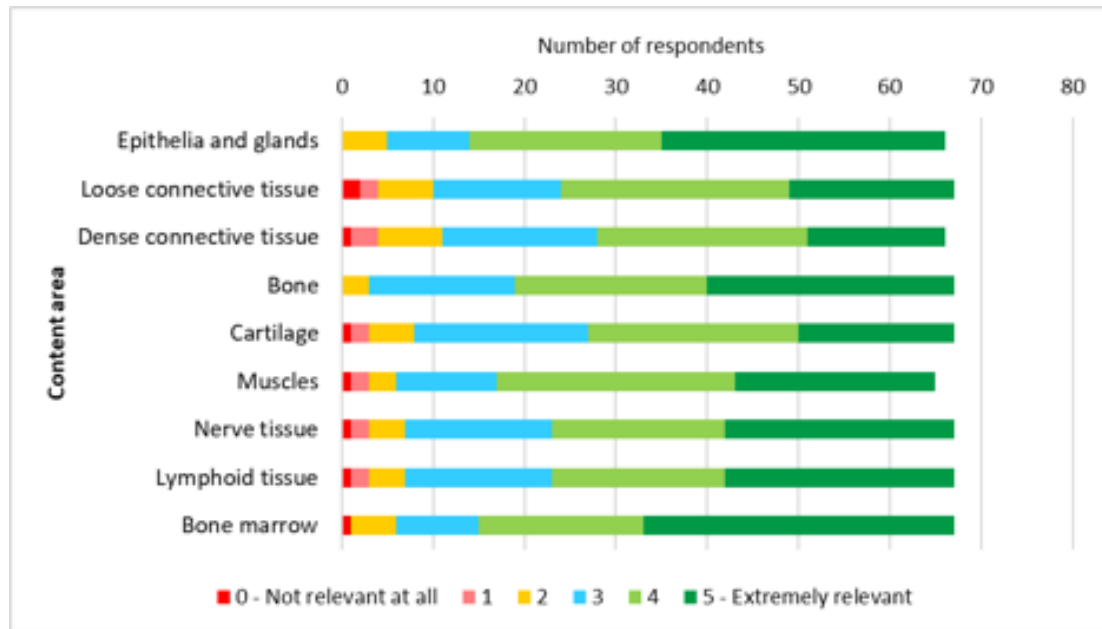


Figure 3: Distribution of responses regarding the perceived relevance and application of different content areas in Basic Histology curriculum

Table 2: Perceived relevance and application of different content areas in System-based Histology (rated on a scale between 0 to 5)

Content area	Mean ($\pm$ SD)	Content area	Mean ($\pm$ SD)
Heart	4.22 ($\pm$ 1.03)	Ovary	4.09 ($\pm$ 1.10)
Vascular system	4.25 ($\pm$ 1.03)	Uterine tube	3.97 ($\pm$ 1.12)
Tracheobronchial tree	4.24 ($\pm$ 0.91)	Uterus	4.25 ($\pm$ 1.03)
Lungs	4.30 ($\pm$ 0.91)	Cervix	4.10 ($\pm$ 1.06)
Salivary glands	4.00 ($\pm$ 1.20)	Vagina	4.03 ($\pm$ 1.06)
Tongue	3.97 ($\pm$ 1.12)	Breast	4.32 ($\pm$ 0.93)
Esophagus	4.37 ($\pm$ 0.86)	Testis	3.99 ($\pm$ 1.22)
Stomach	4.28 ($\pm$ 0.96)	Male genital ducts	3.88 ($\pm$ 1.22)
Intestines	4.34 ($\pm$ 0.87)	Prostate gland	4.03 ($\pm$ 1.18)
Liver	4.27 ($\pm$ 0.89)	Pituitary gland	3.71 ($\pm$ 1.31)
Gallbladder and biliary tree	4.09 ($\pm$ 0.95)	Thyroid gland	4.32 ($\pm$ 0.93)
Pancreas	4.06 ($\pm$ 0.99)	Parathyroid gland	4.03 ($\pm$ 0.97)
Kidneys	4.24 ($\pm$ 0.99)	Adrenal gland	4.00 ($\pm$ 1.20)
Ureter, bladder and urethra	4.16 ($\pm$ 1.09)	Skin	4.10 ($\pm$ 1.10)

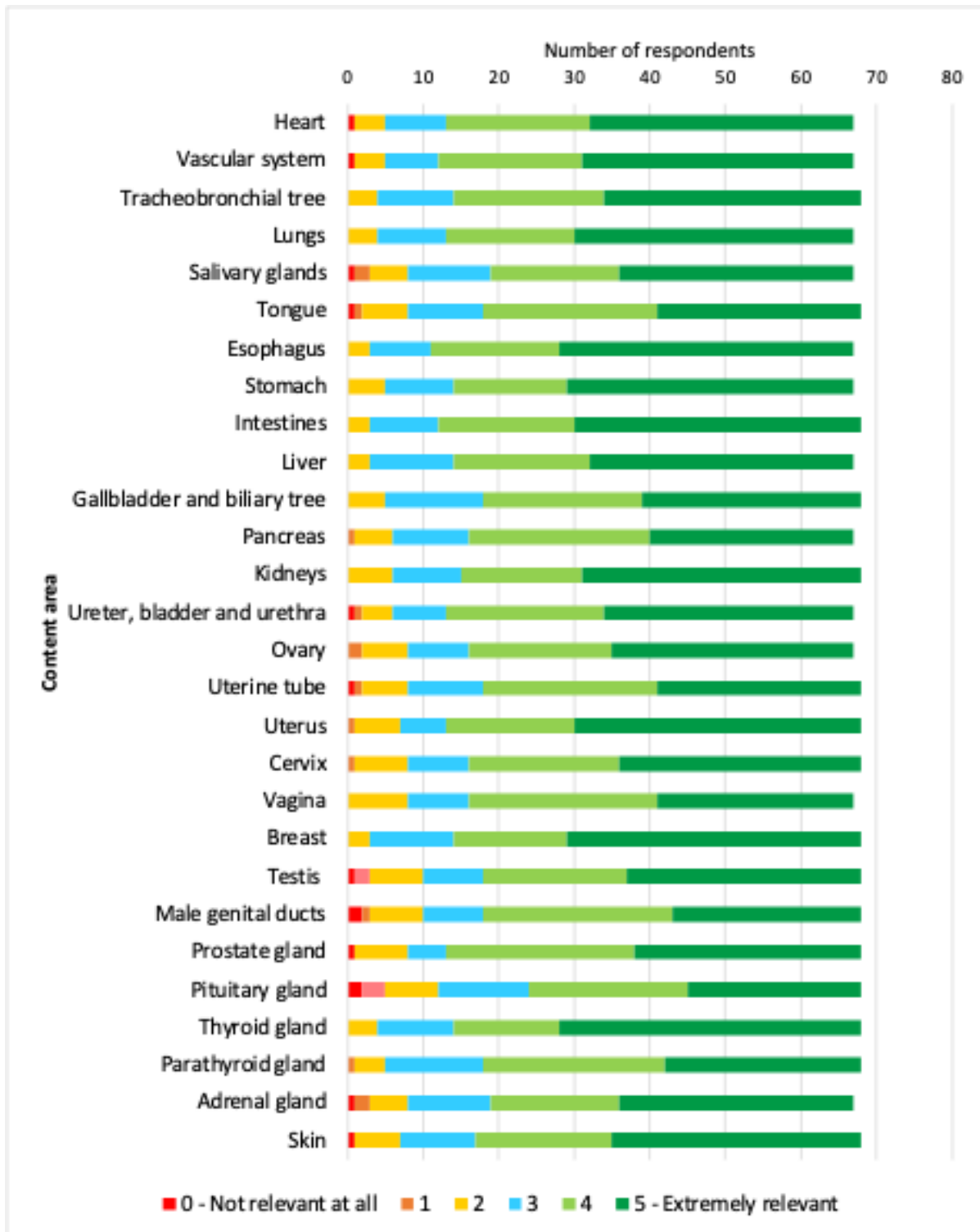


Figure 4: Distribution of responses regarding the perceived relevance and application of different content areas in System-based Histology curriculum

Additional comments and suggestions of the respondents

Several students have suggested to give higher emphasis to the histology of the organs where there are common pathological changes such as kidneys, liver and the gastrointestinal tract and the sites of commonly encountered carcinomas such as thyroid gland, breast, cervix, prostate gland and bone marrow. Some students suggested introducing the basic histopathological features of common diseases during the histology teaching sessions. Two students suggested to have self-learning and self-assessment material (such as short videos and online quizzes) made available through the learning management system for the revision of histology during the later years of the MBBS course.

Discussion

The World Federation of Medical Education (WFME) (2020) has described 'Basic biomedical sciences' as one of the three principal domains of curriculum content in medical education programs. Basic biomedical sciences are described as the disciplines that are 'fundamental to the understanding and application of clinical science' (9). Therefore, even in the modern medical curricula, histology remains an indispensable component, to prepare medical students for learning at the advanced stages of the medical course (11).

This paper presents one of the initial steps in the process of Preclinical curriculum revision in FMAS, RUSL, conducted with the aim of

examining the perceptions of the senior students and recognizing their needs in relation to histology curriculum. In this study, the perceived retention of histology knowledge among fourth-year medical students is moderate, with a mean score of 46.7 out of 100. This finding indicates a significant decline in perceived knowledge since its preclinical teaching, which is a common phenomenon in medical and biological science education (1,5,12,13). This decline had been attributed to several factors including curriculum overload, teaching methods and assessments, students' perception of importance, and lack of clinical relevance and reinforcement (12,13). Without regular reinforcement or application, information learned in the early stages of a course is gradually forgotten which leads to the natural process of 'knowledge decay' (14). Further, it is well-recognized that the adult learners are more motivated by a sense of purpose and are more likely to engage with and retain information when they understand its immediate utility. In medical education, where students are adult learners, this principle is particularly critical (15). Medical students at the preclinical stage frequently struggle to see the connection between microscopic tissue slides and real-world clinical problems. This gap between learning and perceived application of histology, which was observed in the present study with nearly 50% of the respondents stating histology as 'moderately relevant' or less relevant in clinical training was also evident in similar studies conducted elsewhere. A recent cross-sectional survey conducted in Pakistan reported a result comparable to our previous study, where a

significant proportion of the senior medical students had not appreciated the clinical relevance of histology (8,16). Still, several studies with similar methodology, conducted in different settings worldwide have reported a positive perception among medical students regarding the clinical relevance of histology (17-20). Histology knowledge was recognized as a predictor of students' performance in pathology (21) and the application of histology knowledge in pathology education is well-recognized in these studies (17-21), similar to the present study. A key strength of this study is its focus on assessing student perceptions of the relevance of specific content areas within basic and system-based histology, an approach that is rare in the existing literature. Our findings revealed that students perceive the histology of organs commonly affected by pathological changes, such as the esophagus, stomach, intestines, liver, kidneys, heart, vascular system, breast, thyroid gland, uterus, and bone marrow as more relevant to their future clinical practice. However, there is an increasing emphasis in modern medical practice on the molecular and cellular aspects in the diagnosis and management of diseases, emphasizing a higher relevance of knowledge in cytological and basic histological contents in histology curriculum (10,22).

Finding of the present study along with existing research evidence highlights the need for a more clinically integrated curriculum in histology with an early exposure to pathology and clinical disciplines that can aid the students in comprehending disease mechanisms and diagnostic principles. However, it is essential to take a well-informed decision regarding the timing and of delivery

of these integrated histology and histopathology curricula. The question remains whether these subjects should be introduced early in the preclinical years or should be delayed until the students acquire a good understanding of integrated structure and function of organ systems and the basic pathological processes. Another topic of debate is "who is best suited to teach these complex subjects?". A multidisciplinary approach, involving basic science faculty and pathologist and other clinicians in team-teaching, is proposed to bridge the gap between basic histology and histopathology and clinical and diagnostic pathology. This highlights the need of involving all the stakeholders including not only the current students and graduates but also the basic science teachers and specialists in curriculum development in histology because relying exclusively on the students' feedback has the risk of leading to a too narrow vision for curriculum revision (23). The experts and clinicians are likely to have a unique perspective and expectations regarding the fundamental knowledge required of the students, therefore, it is essential to explore their views for a comprehensive understanding of curriculum requirements.

Limitations of the Study: The authors acknowledge a few limitations of the present study, which impact the generalizability and the scope of its findings. The study had a small sample size coupled with a low response rate. This is primarily due to the voluntary nature of online surveys and also likely to be due to the busy schedules of medical students. The low response rate also introduces the possibility of response bias, where the students who chose to

participate may have different perceptions or experiences compared to those who did not. Second, the study did not assess the association of student perceptions with academic performance. As a result, we could not determine whether a student's perceived relevance of Histology is linked to their academic outcomes, such as examination scores in relevant subjects. This limits a deeper understanding of the relationship between perception and performance. Future research in this area should aim to address these limitations to provide a more comprehensive understanding of the role of Histology in medical education. A multi-center approach, including a larger sample of students from multiple medical schools across Sri Lanka is recommended. Additionally, future studies should explore the correlation between student perception and academic outcomes. Finally, a more holistic needs assessment process involving various stakeholders such as recent medical graduates and interns, paraclinical and clinical teachers, pathologists and practicing clinicians, will help to ensure the histology curriculum is relevant, updated, and effective in preparing students and graduates for further learning and future practice.

Conclusions

In this study, it is evident that the fourth-year medical students experience a significant knowledge decay in Histology. They have a variable perception of the relevance and application of histology and its different content areas. The findings suggest a disconnect between the preclinical teaching of

histology and its application in the clinical phase. The students' identification of specific histology content related to common pathologies as more relevant highlights the need for a more clinically integrated and contextualized approach to teaching. Consequently, medical educators and curriculum planners should consider re-evaluating the current teaching methodology and contents in the Histology curriculum. Recommendations include integrating histology content with clinical case-based discussions, increasing collaboration between preclinical and clinical faculty, and emphasizing the histological basis of common diseases. These changes would likely enhance knowledge retention, improve students' perception of the subject's clinical relevance, and ultimately better prepare them for their future careers.

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