



Regular Article

Pathology teaching in different undergraduate medical curricula within and outside the United States: a pilot study



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A B S T R A C T

Pathology education is taught using different curricula in the United States (USA) and abroad. We evaluate and compare the hours spent in different forms of pathology teaching such as lectures, team-based learning (TBL), problem-based learning (PBL), and other methods taught in general and systemic pathology amongst different medical schools within the USA and outside the USA. The total number of lecture hours taught in general and systemic pathology combined was greater in outside schools than within the USA (141 h vs 97.8 h, respectively). Three subjects in general pathology and six subjects in systemic pathology had a significantly greater lecture hours in outside medical schools. The greatest difference was the hours spent in labs were longer for both general and systems pathology in schools outside the USA. The overall utilization of PBL in general and systemic pathology teaching combined was much greater outside the USA compared to within the USA (average overall hours PBL – 97.2 outside vs 16.5 in the USA), however, the reverse was observed for using TBL (average overall hours TBL – 59.5 outside vs 84.5 in USA). Average hours used with other methods of teaching was also greater in outside medical schools compared to USA medical schools (80.8 h vs 44 h, respectively). Pathology teaching in both general and systemic pathology has more extensive lecture hours, laboratory hours, PBL, and other methods of teaching pathology in outside medical schools with different curricula than USA medical schools. TBL is utilized more extensively in USA medical schools.

Keywords: General pathology, Integrated curricula, Semi-integrated curricula, Systemic pathology, Traditional curricula

Introduction

In the past medical schools utilized “traditional” curricula which was divided into two years basic science and two years of required clinical rotations and electives. During the preclinical years, students attend lectures and laboratory sessions to learn the theoretical and practical aspects of the basic sciences in a discipline-based approach. Traditional medical school curricula focus on building a solid foundation in the basic sciences before progressing to clinical rotations.¹ Pathology in traditional curricula was an independent one-year course given in the second year of medical school consisting of general pathology and systemic pathology.^{2,3} While traditional medical school curricula have been the standard for many years, there has been a shift toward more semi-integrated and integrated approaches using more active learning methods to enhance clinical relevance and critical thinking skills. Today there are a variety of different medical curricula in the USA and abroad. These divide into

three main categories of traditional, semi-integrated, and integrated curricula.⁴⁻⁶ Even amongst the semi-integrated and integrated curricula there are different formats and varieties of teaching methods utilized in medical schools for pathology education throughout the world.

The semi-integrated medical school curriculum refers to an educational approach that combines elements of both discipline-based and organ-system-based curricula. It usually consists of the basic science courses first year similar to the traditional curriculum and an organ system based second year.⁷ In this curriculum a general pathology course can be taught in the first year, and systemic pathology follows the organ-based system course in the second year. It is possible that the basic science or systems-based courses do not expand for an entire year, and the students can start required clinical rotations or electives earlier.⁸ Starting clinical rotations earlier also is a feature of integrated curricula. The goal of a semi-integrated curriculum is to provide students with a solid foundation in the basic sciences while gradually integrating clinical

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applications. This approach aims to enhance students' understanding of the relevance of basic sciences to clinical practice and improve their clinical reasoning skills.⁹

Integrated medical school curricula are designed to bridge the gap between basic sciences and clinical practice by integrating these components throughout the entire medical education. Unlike traditional curricula, which often separate basic sciences and clinical rotations, integrated curricula aim to provide a more seamless and interconnected learning experience.¹⁰ They start with a focus on foundational sciences, and instead of studying basic science subjects in isolation that are discipline dependent, the curriculum integrates them into organ-system or theme-based modules. Integrated curricula often provide early clinical exposure like clinical skills training, simulated patient encounters, or shadowing experiences to help students develop their clinical reasoning skills and learn to apply their understanding of basic sciences to real-world scenarios.^{11,12} Integrated medical school curricula strive to create a cohesive and comprehensive learning experience that promotes critical thinking, clinical reasoning, and a patient-centered approach to medicine.^{13,14} By integrating basic sciences, clinical skills, and clinical experiences, these curricula aim to prepare students for the complexities of modern healthcare practice.

Since pathology teaching has transformed due to different curricula used in the United States and abroad, it is of interest to investigate the amount of teaching in different subjects taught in pathology and the methods used in the different curricula. The goal of the study was to identify and compare the different teaching methods that have occurred within curricula in pathology education at medical schools within and outside the USA today. We also focused on the hours spent using different methods of teaching pathology within the different curricula.

Materials and methods

Pathology Course Survey was sent out to all the domestic and international medical schools affiliated with Group Research in Pathology Education (GRPE). The survey was sent to pathology course directors of 67 medical schools with an institutional membership within GRPE in the United States, and 23 individual members from foreign medical schools. The survey instrument is provided as [Supplemental Table 1](#). Lecture hours, TBL hours, PBL hours, and hours spent in other forms of teaching pathology subjects were counted and compared in general pathology and systems pathology subjects in eight USA medical schools (12 % response rate) and six medical schools outside the USA (26.1 % response rate). The mean and standard deviation was calculated for lecture, PBL, TBL, and other forms of teaching of all the subjects taught in medical school pathology in the United States compared to outside the United States.

Table 1
Schools surveyed with type of curriculum and number of teaching faculty.

Schools – Outside USA	Type of curriculum	Number teaching faculty
University of Sao Paulo, Brazil	Integrated	18
Donkuz Eylul University School of Medicine, Izmir, Turkey	Integrated	14
Federal University of Health Sciences of Porto Alegre, Brazil	Semi-integrated	5
Perundurai Medical College, Tamil Nadu, India	Traditional	6
Medical University of the Americas, Nevis, West Indies	Traditional	4
Universidad Rey Juan Carlos, Madrid, Spain	Traditional	4
Schools – Inside USA		
Eastern Virginia Medical School, Norfolk, VA	Integrated	5
UCSF School of Medicine, San Francisco, CA	Integrated	40
University of Kansas School of Medicine, Kansas City, MO	Integrated	20
University of Alabama School of Medicine, Birmingham, AL	Integrated	35
Icahn School of Medicine at Mount Sinai, NY	Semi-integrated	NA
Louisiana State University School of Medicine, New Orleans, LA	Semi-integrated	9
Des Moines University, Des Moines, IA	Semi-integrated	2
University of South Carolina School of Medicine, Columbia, SC	Traditional	6

Listing of the schools surveyed outside and inside the United States of America (USA) with the type of curriculum and the number of teaching faculty involved in teaching pathology at each institution. Not Attained (NA).

Significance was determined using student paired T-test on mean lecture hours from each topic taught in general and systemic pathology from within the United States compared to outside.

Results

Eight USA medical schools and six outside medical schools took part in the survey. Only one traditional curriculum, 3 semi-integrated curricula, and 4 integrated curricula were surveyed for USA schools. There were 3 traditional, 1 semi-integrated, and 2 integrated curricula surveyed for outside medical schools ([Table 1](#)). For most schools offering integrated curricula there were more pathology faculty involved in teaching medical students whether inside or outside the USA.

The total number of lecture hours taught in general and systemic pathology together was greater in outside schools (141 h) than within the USA (97.8 h). This was seen in the mean lecture hours for teaching general pathology in the USA (28.8 ± 22.1) compared to outside (46.3 ± 30.6), and the same for systemic pathology (69.1 ± 40.4 USA, 94.7 ± 48.4 outside) ([Table 2](#)). The overall utilization of PBL was much greater outside the USA compared to within the USA (average overall hours PBL – 97.2 outside vs 16.5 in USA) ([Table 2](#)). PBL was utilized by one school in the USA and no data was given for the systemic portion of that curriculum. Outside the USA three schools had submitted the full data using PBL for both general and systemic pathology teaching. Two schools outside the USA and three schools in USA used TBL in general and systemic pathology within their curricula. Mean overall hours of TBL teaching was 59.5 h outside the USA compared to 84.5 h in USA with much greater use of teaching in systemic pathology subjects (30 ± 12.2 outside vs 69 ± 46.1 in USA) ([Table 2](#)). Average hours used with other methods of teaching was also greater in outside medical schools compared to USA medical schools (80.8 h vs 44 h, respectively). Other methods of teaching included small group case-based teaching, clinical correlation sessions, autopsy, death certificate, tumor board panel, placenta lab, gross specimen lab rotations, hematology reviews, and interactive audience response with question sessions.

Average lecture hours taught in general pathology subjects ([Fig. 1](#)) and systemic pathology subjects ([Fig. 2](#)) show a greater amount of lecture hours for most subjects outside the USA. There were 3 subjects in general pathology (acute inflammation, chronic inflammation, wound healing) and 6 subjects in systemic pathology (gallbladder, kidney, breast, soft tissue tumors, male and female genitourinary) that had significant greater lecture hours in outside medical schools compared to USA ([Table 3](#)). The only subjects with more lecture hours taught in the USA were cardiac pathology, liver pathology, central nervous system pathology, transfusion medicine, and eye, however, the differences were not

Table 2
Time using different methods of teaching in general and systemic pathology.

Mean hours for	Inside USA			Outside USA		
	General pathology	Systems pathology	Total	General pathology	Systems pathology	Total
Lectures	28.8 ± 22.1	69.1 ± 40.4	97.8	46.3 ± 30.6	94.7 ± 48.4	141
PBL	16.5 ± 5.6	NA	16.5	24.7 ± 15.2	72.5 ± 63.5	97.2
TBL	15.5 ± 9.5	69 ± 46.1	84.5	29.5 ± 16.7	30 ± 12.2	59.5
Other	8 ± 3.2	36 ± 20.8	44	31.8 ± 27	49 ± 47.4	80.8

The mean hours with standard deviations of teaching pathology by lectures, problem-based learning (PBL), team-based learning (TBL), and other methods of teaching with overall totals for general pathology and systemic pathology inside and outside of the United States of America (USA). Not Attained (NA).

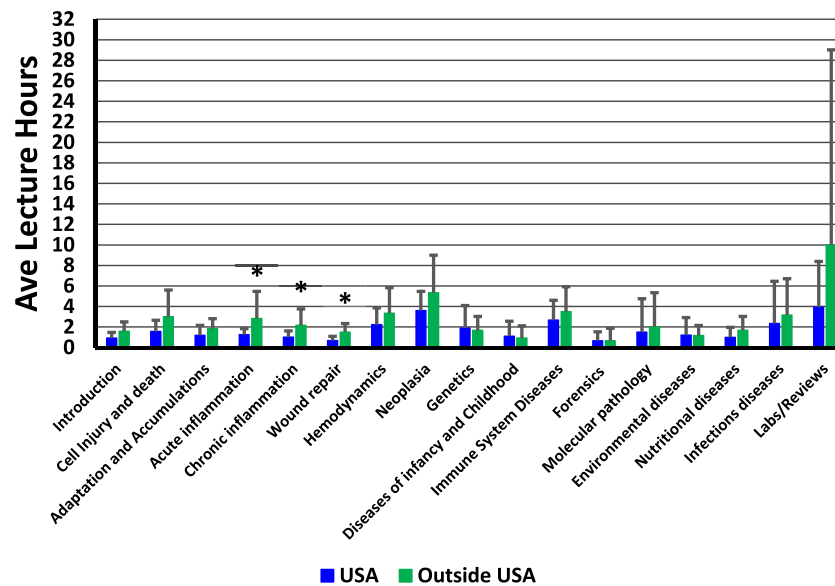


Fig. 1. Average lecture hours taught with standard deviations in different subjects within General Pathology inside the USA (blue bars) and outside the USA (green bars). Student paired T-test - *p ≤ 0.05

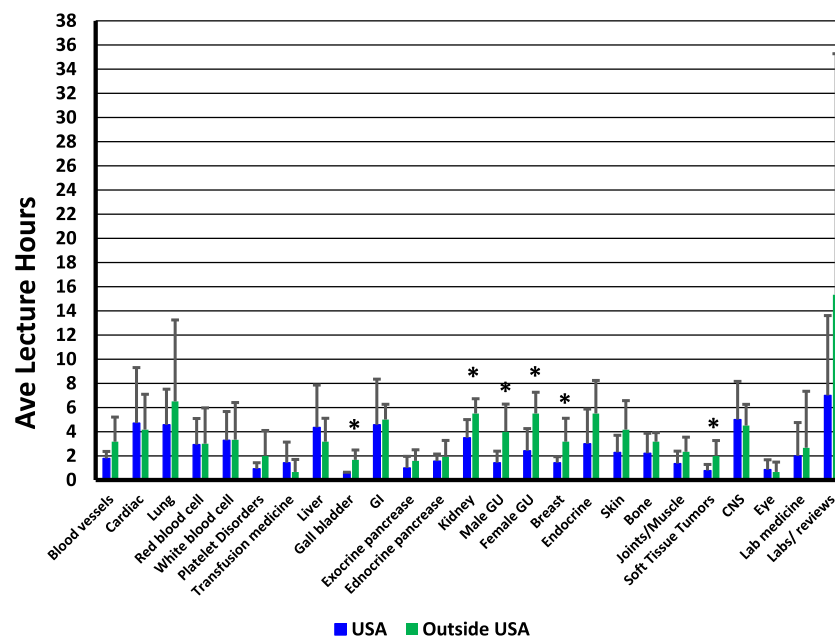


Fig. 2. Average lecture hours with standard deviations taught in different subjects within Systemic Pathology inside the USA (blue bars) and outside the USA (green bars). Student paired T-test - *p ≤ 0.05

Table 3
Significant difference in lecture hours in general pathology and systemic pathology subjects.

Subjects significant difference T-test p values	
General pathology	
Acute inflammation	0.05
Chronic inflammation	0.035
Wound healing	0.012
Systemic pathology	
Gall bladder	0.008
Kidney	0.028
Male genitourinary	0.009
Female genitourinary	0.003
Breast	0.021
Soft tissue tumors	0.017

Subjects with significantly greater lecture hours in outside medical schools compared to USA medical schools. Student paired T-tests were performed comparing lecture hours in general pathology and systemic pathology from outside medical schools compared to USA medical schools. Subjects listed have $p \leq 0.05$.

significant. The greatest difference identified was the hours spent in labs/reviews that were longer for both general pathology (10 ± 19 outside vs 3.9 ± 4.4 USA) and systems pathology (15.3 ± 19.9 outside vs 7 ± 6.6 USA) in schools outside the USA, however, this was not significant due to the large standard deviation (Figs. 1 and 2 last bars in both graphs).

Discussion

A move toward increased integration of basic science and clinical medicine occurred around 1985 after the General Professional Education of the Physician report recommended reducing scheduled class time and lecture hours and promoting students' independent learning and problem solving to help students develop knowledge, skills, values, and attitudes of a physician.¹⁵ This was a project panel that spent 30 months evaluating 83 medical schools, 24 colleges and universities, 21 professional societies, and 11 other groups to improve general professional education in medicine. This gave rise to the increased use of case based active learning methods such as PBL and TBL in small groups and early clinical exposure within the first 2 years of medical school in the USA. This was a large driver in moving from the discipline based, lecture heavy, traditional curricula to more integrated formats. A nationwide study in pathology instruction in 2001 showed that there was a steady increase in the integrated instruction for systemic pathology with much less integration for general pathology, however, the amount of lecture time remained steady over the seven-year period.¹⁶ Changes in curricular organization, content, delivery, assessment, and the use of technology further accelerated in medical schools in North America and abroad after the Carnegie Foundation report in 2010.¹⁷ There was call for curricula reform in four major areas: standardize learning outcomes and individualize learning processes, integrate formal knowledge with clinical experience, incorporate habits of inquiry and improvement into medical education at all levels, and focus on the progressive formation of professional identity.^{17,18} Ten years following the Carnegie report much progress was made in curricular reform, however, the goals around standardized outcomes remained lagging, and many challenges to leadership, faculty engagement, accreditation requirements, and continuous curricular modifications arose.¹⁹ Pathology responded by developing national standards in the form of learning objectives and competencies in pathology necessary for clinical practice.²⁰ This would allow independence in specific curriculum design while assuring all students meet the evolving needs of medical practice. Medical school curricular are continuing to change in the USA and abroad. Active learning methods such as PBL, TBL, and case-based learning grew in foreign pathology programs in Europe, Australia, South America, India, and the Middle East in the early 21st century.^{3,11,21-26}

In this study overall lecture hours, PBL, lab hours, and other forms of teaching pathology to undergraduate medical students were greater in general and systemic pathology teaching outside the USA (Table 2). It is important to note that half of outside medical school had traditional curricula and only one curriculum was traditional in the USA schools surveyed. This could make teaching methods by lecture hours more advantageous. Three of the fifteen subjects such as acute inflammation, chronic inflammation, wound healing in general pathology had significantly greater lecture hours in outside medical schools compared to the USA (Fig. 1, Table 3). Six of the twenty-four subjects lecture hours were significantly greater for systemic pathology in outside medical schools compared to the USA (Fig. 2, Table 3). These systemic pathology subjects consisted of gallbladder, kidney, breast, soft tissue tumors, male and female genitourinary pathology. The standard deviations were large within subjects and teaching methods indicated much variability in these different curricula. This was especially true for lab/review sessions in both general and systemic pathology which had greater hours in schools outside the USA.

PBL began to be implicated in medical education within the west increasingly in the early 1990s, but is now used around the world.^{27,28} PBL helps integrates basic and clinical courses to improve clinical reasoning, however, it requires sufficient numbers of teachers, assessment, feedback, and proper monitoring.²⁹ The active learning portions of the curricula in this study showed that PBL was used more than TBL in schools outside the USA. The total number of PBL teaching hours is 97.2 outside the USA compared to 16.5 inside the USA (Table 2). However, there was only one school inside the USA that used PBL and the data for the systemic portion of the curriculum was unavailable, so it just represented the PBL used in general pathology for one school in the USA. Three schools outside the USA used PBL as a teaching method in both general and systemic pathology which consisted of two schools with an integrated curricula and one semi-integrated curriculum (Table 1). Systemic pathology had a greater use of PBL in these outside schools with the mean hours with standard deviation being 72.5 ± 63.5 compared to 24.7 ± 15.2 in general pathology teaching. Even with the use of PBL as a teaching method in the outside schools, there was a large standard deviation and variation of use amongst subjects in the different curricula in outside schools.

TBL provides an innovative approach to student-centered learning by applying knowledge through a sequence of activities that includes individual work, teamwork, and problem-solving activities.³⁰ Better outcomes in TBL are seen when there is a standardized framework, testing process, immediate feedback, and the use of evidence-based practice in implementation and facilitation of TBL.³¹ In this pilot study, three schools inside and two schools outside the USA used TBL as an active learning teaching method. TBL was the preferred teaching method in the USA compared to outside. The total number of TBL mean teaching hours is 59.2 h outside the USA compared to 84.5 h inside the USA (Table 2). Outside the USA the mean hours of TBL were about equivalent in general pathology (29.5 ± 16.7) compared to systemic pathology (30 ± 12.2). Inside the USA mean hours of TBL was much greater in systemic pathology (69 ± 46.1) compared to general pathology (15.5 ± 9.5), however, there is more time in teaching systemic pathology than general pathology. In systemic pathology mean hours of TBL use was over twice as much in USA compared to outside schools (69 ± 46.1 vs 30 ± 12.2 respectively).

This is a small pilot study of curricula with six schools outside the USA and eight schools inside the USA participated in the survey on pathology teaching at their institutions. Half of the curricula were traditional in outside schools with only one being traditional in USA schools studied. Most curricula were nontraditional in USA, and this could misrepresent the amount of lecture hours and active learning methods in pathology education comparing USA and outside curricula. Further investigation with more schools surveyed inside and outside the USA to see if these findings are verified is necessary. The large standard deviations show

that there is large variability within curricula in pathology education even within traditional, semi-integrated, and integrated curricula.

Conclusions

This investigation demonstrated that outside medical schools had more overall mean hours of pathology teaching in each category except TBL. There was high variation in general and systemic pathology teaching hours regardless of the curricular type or teaching methods utilized. Larger numbers of schools need to be surveyed inside and outside the USA to verify the trends found in this pilot study.

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 article.

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Supplementary data

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