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Preclinical Medical Student Hematology/Oncology Education Environment

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Abstract To better prepare medical students to care for patients in today's changing health-care environment as they transition to continuing their education as residents, many US medical schools have been reviewing and modifying their curricula and are considering integration of newer adult learning techniques, including team-based learning, flipped classrooms, and other active learning approaches (Assoc Am Med Coll. 2014). Directors of hematology/oncology (H/O) courses requested an assessment of today's H/O education environment to help them respond to the ongoing changes in the education content and environment that will be necessary to meet this goal. Several recommendations for the improvement of cancer education resulted from American Association for Cancer Education's (ACCE's) "Cancer Education Survey II" including a call for medical schools to evaluate the effectiveness of current teaching methods in achieving cancer education objectives (Chamberlain et al. J Cancer Educ 7(2):105-114.2014). To understand the current environment and resources used in medical student preclinical H/O courses, an Internet-based, Survey Monkey®-formatted, questionnaire focusing on nine topic areas was distributed to 130 United States Hematology/Oncology Course Directors (HOCDs). HOCDs represent a diverse group of individuals who work in variably supportive environments and who are variably satisfied with their position. Several aspects of these courses remain relatively unchanged from previous assessments, including a predominance of traditional lectures, small group sessions, and examinations that are either written or computer-based. Newer technology, including web-based reproduction of lectures, virtual microscopes, and availability of additional web-based content has been introduced into these courses. A variety of learner evaluation and course assessment approaches are used. The ultimate effectiveness and impact of these changes needs to be determined.

Keywords Education · Medical student · Curriculum · Compensation · Training · Technology

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Introduction

Postgraduate medical education has been evolving to be competency- and outcome-based. Undergraduate medical education in the USA has been slow to follow in this direction. In response to competency-based formats for postgraduate education and training, several US national

organizations (e.g., Association of American Medical Colleges [AAMC] and the Alliance of Academic Internal Medicine [AAIM]) and individual medical schools are defining milestones and developing entrustable professional activities for medical students as they progress to being prepared to enter residency training [1,2]. The American Association for Cancer Education (ACCE) conducted the Cancer Education Survey II between 1989 and 1990 [3]. From this study, eight recommendations for the improvement of cancer education were provided, including 'the training of cancer educators in the process of instructional planning; a call for medical schools to evaluate the effectiveness of current teaching methods in achieving cancer education objectives; the development and implementation of computer-assisted instruction programs'; and others [4].

The ability to identify what technology is available, where it can be useful and effective, what faculty expertise is needed and available to use these technologies to teach, and what resources are needed to implement these technologies into a medical school preclinical Hematology/Oncology (H/O) course presents challenges of their own. In anticipation of significant changes that will be introduced into medical school curricula, there is clearly a need to assess the current H/O curriculum and teaching interventions used to deliver the information that medical students need as they prepare to participate in direct patient care.

Background

It has been suggested that undergraduate medical education needs to change in order to better prepare medical students to care for patients in today's changing health-care environment [5]. Medical school is where the foundation of knowledge and skills to prepare physicians for life-long learning is established. Despite the perception that medical education is changing at a rapid pace, the optimal method of teaching preclinical medical education continues to be debated [6–8]. For example, the typical preclinical, undergraduate, medical student H/O course consists of a broad set of topics to be covered with use of traditional lecture-based sessions, laboratory (real or virtual), and (perhaps) other teaching formats. Courses are under constant pressure to adapt to an increasing quantity and complexity of material to be taught, finite time allotment, and ever-changing medical student learning strategies. In addition, an increased number of course hours is needed to integrate newer teaching methods, but many courses have had their allotted number of course hours remain static or decrease [7]. Although the current generation of learners is generally well-skilled at using computer-based technology and there is a movement to transform the way that medical students are taught, medical schools have not always kept up with effective use of newer technologies in their curricula. In recognition of the need for medical student education to change, the American Medical Association has underwritten grants to medical schools to facilitate medical education reform [9].

Resource limitations of time, money, access to technology, and administrative support are primary concerns when developing and delivering a nonrevenue generating activity such as a medical school course. In today's academic medical environment, there is an increasing focus and expectation for faculty to generate clinical revenue as measured by the work relative value unit (wRVU) and/or receiving "effort" credit for their nonrevenue generating activities [10–13]. Although teaching has always been an expected part of the academic faculty members' job description, there has typically been little to no direct effort or salary support provided for these activities. It is unknown if the increased expectations for establishing recognized effort or salary support has affected the ability to run preclinical medical courses (e.g., recruitment of faculty to teach, course directors).

A previous survey of hematology course directors conducted in 2001–2002 characterized the status of second year H/O courses a decade ago [14]. Despite this, hematology/oncology course directors (HOCDs) stated their impression that the current environment for providing a preclinical H/O course was significantly different than in the past years and that there was a need for more change as the educational needs and environment were changing. As many US medical schools have been reviewing and modifying their curricula to possibly include newer adult learning techniques, there was a universal interest expressed that an assessment of the current environment and structure of preclinical H/O medical student courses at different institutions was needed [15]. As a result, an updated and more thorough survey of HOCDs in US medical schools was conducted.

Methods

An Internet-based survey was developed to update the results of the topics covered in a previous survey [14] and to encompass topics not previously covered but identified as being of interest to current HOCDs [15]. The survey consisted of 54 questions grouped into nine different main topic areas, including (1) course director demographics, (2) course director compensation, (3) job satisfaction, (4) structure of course, (5) references/articles/assigned reading, (6) evaluation/testing of students, (7) teaching methods, (8) course changes, and (9) use of educational products (Supplemental material). Questions required a single- or multiple-check box choice, a Likert scale response, or a short open-ended response. This survey study received exempt status by the University of Florida's Institutional Review Board.

One hundred thirty HOCDs at medical schools across the USA were identified by name and e-mail address. Seven medical schools did not have an individual that could be identified as the "course director" due to relevant topics either being delivered independently or immersed in courses with diverse (not specifically focused on hematology/oncology) content. The lack of a defined HOCD at these seven medical schools was confirmed by one of the authors (SDG) contacting the appropriate medical schools' deans.

An e-mail introducing the survey was sent to HOCDs prior to its distribution. The anonymous, Survey Monkey®-formatted survey was sent via e-mail to 130 HOCDs from June 2010 through October 2010. In addition to the original invitation to participate, three follow-up reminder e-mails were sent. Not all HOCDs answered every survey question, so the total number of responses varied between questions and was typically less than the total number of respondents. To obtain information that is typically not readily shared (e.g., financial data), survey responses were collected anonymously.

Data was provided as summary totals for the multiple option questions, and free text was provided for the open-ended short answer responses. Means and median values were determined through standard calculations for those questions with defined, multiple option responses, and for Likert scale responses. Free text responses were reported in a list of all responses for a given question; when possible, these were grouped by response type for comparison.

Results

As stated earlier, the Cancer Education Survey II's recommendations included the training of cancer educators in the process of instructional planning; a call for medical schools to evaluate the effectiveness and adaptability of current teaching methods in achieving cancer education objectives; and a call for medical schools to evaluate the effectiveness of current teaching methods in achieving cancer education objectives [16]. To put these evaluations in perspective, it is important to understand the current cancer education environment. This study provides an assessment of the current environment for medical student preclinical H/O education.

Hematology/Oncology Course Director Demographics and Characteristics

A total of 68 (52 %) of the 130 HOCDs contacted completed the survey. The demographics and academic status of these HOCDs are summarized in Table 1. Sixty percent of HOCDs are male and a similar percentage is over the age of 50 years. The majority (81 %) of HOCDs were Caucasian. Sixty-nine percent of HOCDs were at the associate professor level or higher. HOCDs consist of hematologists, hematologist/oncologists, hematopathologists and, to a lesser degree, medical oncologists or other specialists.

Table 1 Demographics and academic appointments of hematology/oncology course directors (HOCDs)

	Number	Percent
Gender		
Male	41	60
Female	27	40
Age		
25–40	7	10
41–50	21	31
51–60	32	47
Over 60	8	12
Ethnicity (self-identified)		
Caucasian	55	81
Hispanic	3	4
American Indian	1	2
African American	1	2
Other	8	12
Years as HOCD		
Less than 3	22	32
3–5	16	24
5–10	9	13
Greater than 10	21	31
Subspecialty		
Hematology	18	27
Hematology/oncology	20	29
Hematopathology/pathology	19	28
Pediatric hematology/oncology	4	6
Medical oncology	2	3
Other	5	7
Academic appointment		
Professor	29	43
Associate professor	18	26
Assistant professor	21	31

Course Structure

Hematology/oncology is primarily (n=55, 93 %) taught in the second year of the medical school curriculum. Medical school class size remains large with 36 % (n=21) enrolling 101–150 students, 36 % (n=21) enrolling 151–200 students, and 10 % (n=6) enrolling over 200 students. However, 19 % (n=11) of medical schools have less than 100 students. Approximately half of the H/O courses are taught independently (n=31, 53 %) and the remainder (n=28, 48 %) combine H/O with other medical topics, such as with cardiovascular medicine or dermatopathology to cite a few examples. Although the content of individual courses varies, most consist predominantly

of malignant and non-malignant hematology topics. The majority of courses (n=50, 85 %) include only medical students and do not enroll allied health professionals or PhD students. Twenty-eight percent (n=17) of HOCDs have a codirector and 14 % (n=6) have an assistant director. Most courses utilize 5–20 faculty (mean=10.6) for lecturing and many use up to 25 faculty (mean=11.7) for small group/case-based learning.

The average number of total course hours allotted to the hematology/oncology course was 37 h, with nearly half (48 %) of programs in the range of 30–49 h. A minority (7 %) of courses are allotted over 70 h. Red cell metabolism/disorders (mean=6.8 h; ≥10 h in 27 % of courses) and malignant hematology (mean=9.2 h; ≥10 h in 13 % of courses) encompass the greatest number of teaching hours in the majority of H/O courses. In contrast, only 6 % of courses allotted ≥10 h for non-hematologic oncology topics (mean=2.2 h) and 44 % of courses had no non-hematologic malignancy topics.

References/Articles/Assigned Reading

Greater than 60 % of courses still use a reference textbook for required or suggested reading. Approximately 20 % of HOCDs use a reference atlas or textbook to teach blood cell morphology. The utility of centrally developed teaching aids for HOCDs is unknown. We explored the use of educational materials and resources that were developed centrally and made widely available (at no cost), by a subspecialty society (i.e., American Society of Hematology; ASH). Relevant web-based tools designed to help teach medical students include teaching cases [17], a blood and bone marrow electronic slide library [18], and H/O course learning objectives [19]. Of these, the slide library is used most commonly with 69 % (n=36) of HOCDs using this tool at least occasionally. The teaching cases are used by 58 % of HOCDs as well. Of interest, a substantial number of HOCDs reported that they did not know that these tools were available (teaching cases n=17, 31 %; slide library n=11, 21 %; learning objectives n=28, 52 %). Only a minority (n=17, 32 %) of HOCDs include efforts to promote the field of H/O as part of their second year course through development of H/O interest groups, discussing research opportunities, or use of promotional videos.

Teaching Methods

Traditional lecture format remains the most prominent teaching method and was used in all courses to varying degrees (range=3–40 h per course; mean=20 h). Ninety-six percent (n=50) of HOCDs have integrated small group and case-based teaching approaches into their courses (range=0–40 h per course; mean=10 h). Other teaching modalities were assessed, but due to a lower number of respondents, it is difficult to know if the data is representative of most H/O courses. Use of audience response devices are used by 76 % (n=29) of those who responded and 50 % (n=22) utilize web-based learning techniques. However, use of these approaches is limited to only a few of the total course contact hours (mean of 3 and 2 course hours, respectively). Patient presentations and interviews are used by 85 % (n=27) of responding HOCDs for a minority (≤3) of their allotted teaching hours. Seventy-eight percent (n=32) of courses include a laboratory component, typically for less than 5 h of the course allotment. These laboratory sessions teach peripheral blood smear preparation and interpretation, blood and bone marrow morphology, pathology, coagulation testing, and type and screen preparation. Despite the inclusion of these "laboratory" sessions, 90 % of H/O courses now primarily use lectures and computer images to teach pathology/morphology.

Testing and Course Evaluation

Medical student performance evaluation is necessary to assess the acquisition of knowledge and to guide and motivate learning. Nearly all courses (n=56, 98 %) use written or computer-based testing as the primary student evaluation tool. Multiple choice questions are by far the most common format for these examinations (n=54, 96 %). About one-fifth of courses (n=13, 23 %) also use written essays and one-fifth (n=12, 21 %) use question/answer matching. Almost half of courses (n=27, 48 %) test identification of blood cell morphology. Attendance is used as part of the final grade in 28 % (n=16) of courses, while small group participation is evaluated in 35 % (n=20) of courses. Fourteen percent (n=8) of the courses include a laboratory component as part of the final grade. Approximately 60 % (n=33) of courses are graded, while the remainder are pass/fail. Tests are written exclusively by the HOCD in about one third of courses (n=18, 32 %) and by the joint effort of the HOCD and individual lecturers for the majority of courses (n=35, 62 %). Exams are exclusively focused on hematology in 40 % (n=22) of courses and on hematology and medical oncology in approximately 31 % (n=17) of courses. Additional medical topics are included in 33 % (n=18) of courses. Exam questions/answers are reviewed with students after the examination in over half of the courses (n=29, 53 %).

Course assessment and evaluation can be a useful tool to identify the course's strengths and weaknesses. Eighty-one percent (n=46) of courses impose a mandatory course evaluation by students, most commonly computer-based. HOCDs, instructors, and/or curriculum committees receive the evaluations in >90 % (n=53) of courses. The vast majority (n=50, 89 %) of H/O courses have implemented changes as a result of student evaluations/suggestions.

Compensation and Job Satisfaction

Less than 50 % of HOCDs receive financial or full-time equivalent (FTE; effort)-related compensation for their H/O course responsibilities, although there is a wide range of what is provided to those receiving support (Fig. 1). Sixty percent (n=37) of HOCDs report no salary compensation, and 52 % (n=32) report no FTE support. In contrast, 3 % (n=2) receive over 20 % FTE and 5 % (n=3) receive>$20,000/year in salary supplement. Other forms of support include protected time (n=9, 23 %), secretarial support (n=31, 78 %), and audiovisual technical support (n=20, 50 %). Thirty percent (n=12) of HOCDs receive a monetary, non-salary allotment for implementation of the course, typically $1000–$5000. The majority of course instructors receive no compensation of any form.

Sixty-seven percent of HOCDs report being satisfied (n=28, 46 %) or very satisfied (n=13, 21 %), while 20 % report being unsatisfied (n=4, 7 %) or very unsatisfied (n=8, 13 %) in their HOCD role. HOCDs' level of satisfaction with several different aspects of the H/O course was assessed with a scale ranging from 0 to 4 (very unsatisfied to very satisfied, respectively). Reasons cited for dissatisfaction include a lack of financial support for their course director role (satisfaction rating 2.32/4), lack of financial support for the H/O course

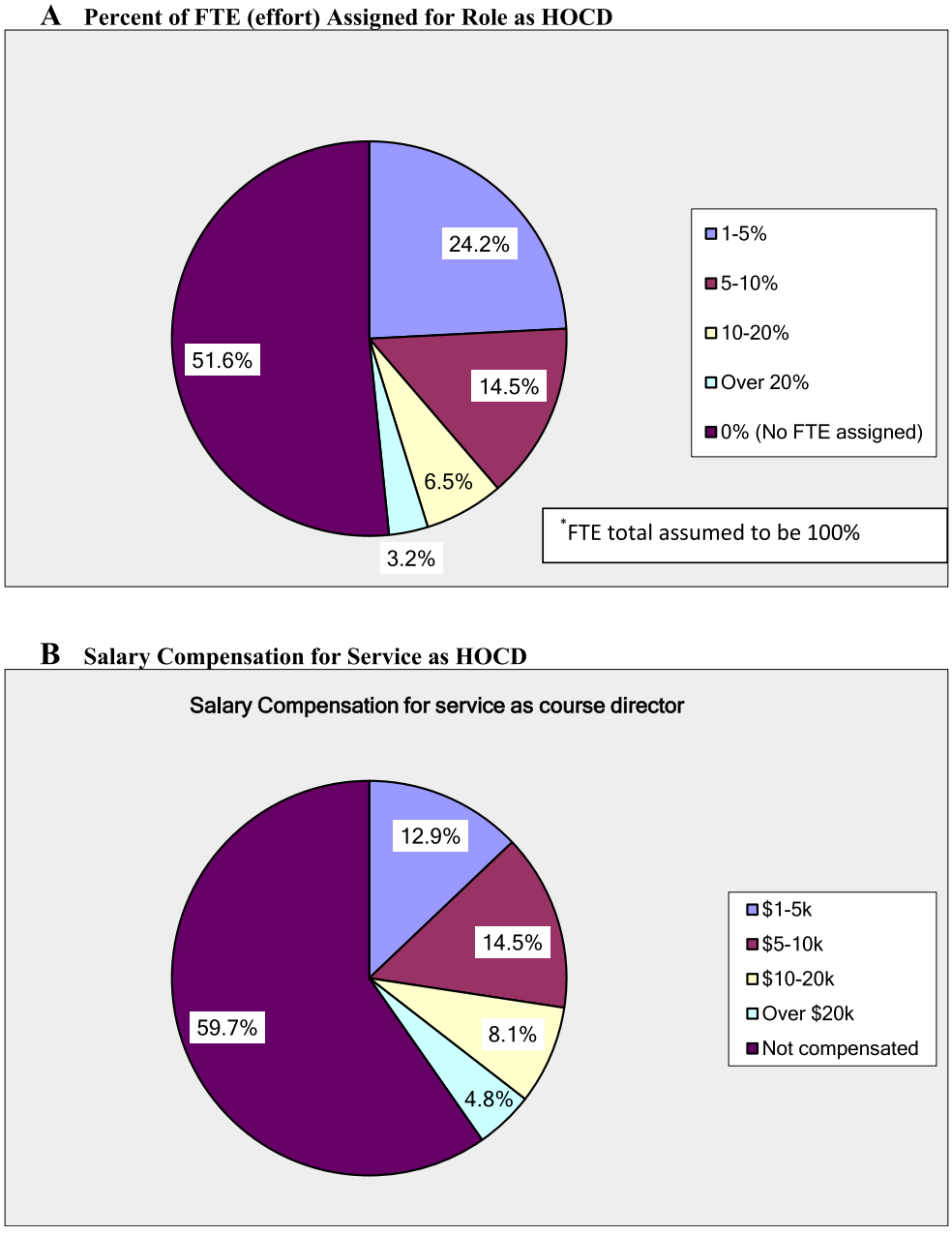

Fig. 1 Effort (FTE) and salary support for hematology/oncology course directors (HOCDs). **a** Percent of FTE (effort) assigned for role as HOCD. **b** Salary compensation for service as HOCD. HOCDs were asked to state how much (percent) effort (**a**) and how much (dollar amount) salary support (**b**) that they are provided for their role as course director

(satisfaction rating 2.66/4), and lack of protected time (satisfaction rating 2.37/4). Factors contributing the most positively to job satisfaction included student interest in H/O (satisfaction rating 3.95/4), curriculum content (satisfaction rating 3.93/4), value placed on the H/O course by the medical school (satisfaction rating 3.69/4), and student performance on the United States Medical Licensing Examination (USMLE) (satisfaction rating 3.58/4).

Changes in the Hematology/Oncology Course

HOCDs were queried regarding course changes implemented over the prior 3 years. Most reported a decrease in the number of lecture and laboratory hours, with a compensatory increase in small group format and patient participation (Fig. 2). Over the last 3 years, the time devoted to individual topics within H/O has generally remained stable, with a minority of the HOCDs reporting an increase or decrease in time allotted to varying subject topics. No increase or decrease in course funding or support personnel was reported by the majority of course directors over this 3-year period. Of note, HOCDs report an increase in student interest in H/O and student satisfaction with the course during this time (Fig. 2).

Discussion

There is much attention being directed toward modifying undergraduate medical education curricula and techniques to better prepare students for transition to providing patient care as residents [5]. Many US medical schools have been reviewing and modifying their curricula and are considering integration of newer adult learning techniques, including team-based learning, flipped classrooms, and other active learning approaches [9]. Much attention is being given by medical schools to demonstrate the value of these changes. This study sought to characterize the current environment for specialty-oriented H/O preclinical medical education, to better prepare for future curricular changes and as recommended by the Cancer Education Survey II. The results of this survey should provide current HOCDs comparative data to guide and advocate for H/O course development and resources. The H/O course can also serve as a model for other second year medical school courses, as the curriculum typically integrates basic science with clinical application. It also has laboratory-based content, thus allowing for a broader view of teaching methods used today.

The majority of HOCDs are Caucasian, over age 50, and at the academic rank of Associate Professor or Professor. Although most (n=42, 62 %) HOCDs are either adult or pediatric hematologists or hematologist/oncologists, a substantial number (n=26, 38 %) are from other disciplines. It is not known what impact this has on students' H/O education or their perception of the specialty.

The years of service as HOCD appear to be evenly distributed between <3, 3–10, and >10 years, demonstrating a mix of those with recent turnover to those with substantial longevity in this role. This represents significant numbers of HOCDs who can potentially mentor those with less experience. The presence of less experienced HOCDs potentially allows for the introduction and early consideration of new teaching

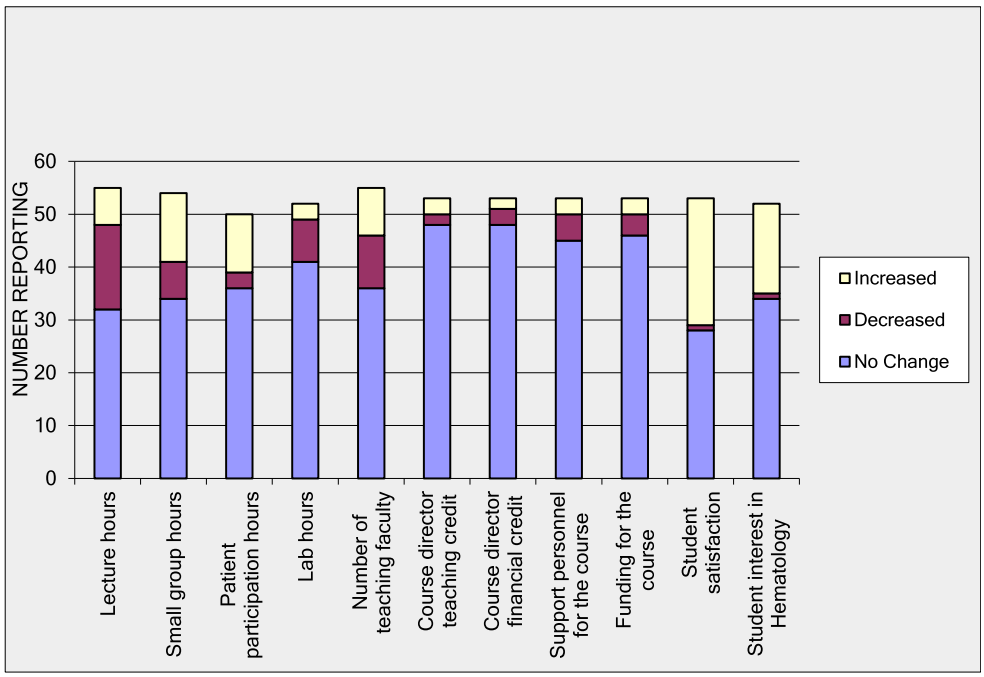

Fig. 2 Changes that have occurred in various aspects of the hematology/oncology course over the previous 3 years. HOCDs were asked to comment on increases, decreases, or no change in several course structure; teaching environment; and perceived outcomes components of their hematology/oncology course over the previous 3 years

approaches, new technologies, and new curriculum ideas. Data was not individualized, so we cannot discern whether younger course directors were more likely to use newer technology.

Regardless of the amount of experience, the time and effort provided by the majority of HOCDs to their courses is typically with no salary support or FTE effort credit. However, a small number of HOCDs receive over $20,000/year of salary support. Salary and/or FTE support will likely be increasingly important as junior and technology-oriented faculty are recruited to teach and to become HOCDs, as medical schools assign wRVUs to these activities, and as a demonstration that medical education career paths are valued by the school.

There is great variability in the number of hours, lectures, small groups, content, and instructors dedicated to the H/O course across medical schools, emphasizing that there is variability in students' exposure to H/O during their preclinical education. It appears that there has been a slight increase in the time allotted for the H/O course since 2002 [14]. Given that many specialties are unlikely to receive significant additional student contact time, how to best handle the ever-expanding knowledge of the specialty, and how to use the course to increase recruitment into the specialty is unknown. As a result, effective means to communicate more information in a finite amount of time will have to be developed. This could include the use of educational content developed at a national level (e.g., via subspecialty societies) as a means to enhance non-classroom H/O education [17]. Many schools have introduced a "flipped classroom" curriculum where students review prepared material outside of the classroom and faculty contact time with students is more interactive than in the past. Whether new teaching technologies will be more efficient and able to offset the greater amount of material to be taught in a stagnant amount of contact time remains to be seen.

Recent changes in the H/O course have included the introduction of novel teaching formats, new technology, and tools that have been integrated into the educational curriculum, as well as expansion of the traditional classroom to include virtual and online (Internet-based) teaching and materials. Concomitant with the expansion of new technologies, demands on faculty time are increasing and budgets are tightening at many medical schools. These changes are thought to affect not only the educational curriculum and format of these courses, but also faculty satisfaction with being a HOCD.

Although traditional, large group, and didactic lectures continue to be a standard feature of H/O courses, there has been an increase in alternative didactic teaching and Internet-based educational materials, albeit only for a minority of teaching hours in most courses. Likewise, laboratory-based components of the curriculum are leaving the microscope and are being replaced by computer images (including virtual microscopes) in many schools. This raises concern that future H/O trainees and specialists will have limited ability to use a microscope for blood, bone marrow, and other tissue evaluations. H/O fellowship programs will need to adapt teaching of this previously mastered skill set into its already robust curriculum.

Many HOCDs desire educational materials that are developed by topic experts and/or those with demonstrated educational effectiveness [15]. The role of subspecialty societies and other entities in developing educational materials to be used broadly by course directors appears to be variably successful. Internet-based learning and alternative learning techniques, such as problem- or case-based learning, are time-intensive to develop and require an understanding of teaching methods to be successful. Subspecialty organizations can potentially invest more time and resources into developing effective teaching tools that can help reduce the demands on HOCDs while providing a high-quality product. Assessing what tools course directors would find useful would be worthwhile, however, before dedicating significant resources (financial and nonfinancial) toward these efforts.

There are a few limitations of this study. Due to the constraints of our survey design, HOCDs were only able to identify themselves with one ethnic group; this did not allow those with multiple ethnic backgrounds to be represented fairly. Further, as a result of the anonymous nature of the survey, it is not possible to assess the impact of geographic location, or of public- vs. private-funded status, of the institution on the results. In addition, there was not an exhaustive evaluation of specific, novel teaching methods [20–22]. As with most surveys, the collected data was self-reported and accuracy could not be confirmed. Finally, for some questions, including those surrounding the use of new teaching methods and technologies, not all HOCDs answered each question. Thus, the percentages of HOCDs who use each of these technologies may be misrepresented.

Despite these limitations, this survey provides an up-to-date assessment of the current environment for the H/O education of second year medical students in the USA. Compared with a previous study by Broudy and colleagues [14] that looked at the hematology/oncology preclinical education environment in 2001–2002, there has been a small increase in the number of hours dedicated to hematology/oncology (mean 37 vs. 33 h), a substantial increase in centrally developed and available educational content, less hands-on laboratory time and microscope learning, with no change in the predominant use of a large lecture format or in the number of faculty who are involved with teaching the content. There has been no apparent change in the amount of course funding or personnel support.

Although medical student education in the USA is increasingly moving toward being competency- and outcome-based, this study shows that much of the format and environment for undergraduate medical education has remained the same over

the past 8–9 years. However, there have been changes in some of the structure and content of second year medical student H/O courses. At least some of this is the result of the learning styles of today's students and the overall expectations of faculty. Although there are technological advances that could (and do) influence the way H/O is taught, most courses do appear to take full advantage of these new technologies quickly in response to the changing way that students learn. In the end, however, it is not known if any of these new technologies or alternative teaching methods lead to an improved understanding of H/O disorders or are effective in attracting physicians into H/O careers.

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Conflict Of Interest None

Ethical Approval The survey instrument used was given exempt status by the University of Florida's Institutional Review Board.

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