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"Fighting an uphill battle": A mixed methods exploration of surgeon involvement in medical schools' preclinical curricula☆

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ABSTRACT

Background: Limited exposure to surgeons early on in medical school may adversely impact students' clerkship experiences and professional development. This explanatory sequential mixed methods study investigates a perceived discrepancy between surgical and nonsurgical instructors in our institution's preclinical curriculum.

Methods: The demographics of preclinical faculty were assessed before and after a curricular reform. Semi-structured interviews with 13 surgical faculty explored barriers and facilitators to surgeon involvement. Responses were inductively coded and thematically analyzed.

Results: Surgeons' contributions to preclinical instruction fell from 10% to 5% across the curriculum reform. Barriers both leading to and reinforced by surgeons' limited involvement relate to surgeon, medical school, and student factors. Participants proposed three solutions to barriers in each domain.

Conclusions: Surgeons provide a minority of our preclinical instruction and may be disproportionately impacted by reform efforts. Deliberate efforts are necessary to increase opportunities for surgeons to engage with preclinical medical students.

Introduction

Medical students' exposure to surgeons has traditionally occurred within the context of their clinical experiences.[1–4] Unfortunately, students begin their clerkships with a number of negative perceptions about surgeons and surgical careers.[5,6] Surgeons have long recognized the preclinical years as a prime opportunity to engage medical students[7,8] through such activities as extracurricular discussions or seminars,[9,10] mentorship programs,[11–13] student-run interest group events,[14–17] and elective courses.[4,18] Although these activities have demonstrated positive effects on students' attitudes about surgeons and surgical careers, they can only impact students who are already interested enough in surgery to participate. Teaching in core preclinical courses would be a more effective way for surgeons to reach all students, but this has not been fully explored.[3]

The topic is especially relevant given the frequency at which medical schools are engaging in preclinical curricular reforms. The AAMC reports that 84.3% of U.S. medical schools are either planning a curriculum change, currently undergoing one, or have completed one in the past three years.[19] Anatomy courses, which have historically been the best opportunity for surgeons to teach in preclinical curricula, comprise an increasingly smaller component of students' coursework.[1,2,20–23] While course content is important, medical educators must also consider their schools' "hidden curricula," including such signals as the role models to whom their students have access.[24,25] Specifically, educators should strive to expose students to a wide range of faculty mentors who can positively influence their career trajectories.[26,27] It remains to be seen how such curricular reforms may impact surgeons' ability to become involved.

We completed an explanatory sequential mixed methods study to investigate a perceived discrepancy between surgical and nonsurgical instructors in our institution's preclinical curricula just

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before and just after it underwent a major reform in the fall of 2015 that shortened the pre-clerkship period and employed a flipped-classroom, case-based collaborative learning approach.[28] In this new curriculum, foundational basic science content is covered in the first three months, and physiology and pathophysiology are taught in clinically focused integrated organ system blocks over the next year. Anatomy instruction includes an abbreviated dissection lab course at beginning of the year and prosection sessions during the organ system blocks. Students also participate in a longitudinal clinical skills course. Our hypothesis was that surgeon involvement in the preclinical courses significantly declined across the curriculum reform and that surgeons may have suggestions to increase their access to preclinical medical students.

Methods

Determination of surgeon involvement

Surgeon involvement in the preclinical curriculum was operationalized as "Instructional Time," (IT) a standardized metric used by the Harvard Medical School (HMS) Office of Finance to document the contributions of all paid teaching appointments. The main outcome of this study was the proportion of IT contributed by various instructor subgroups; while a decrease in IT due to the reform would affect all preclinical instructors, changes in proportions would suggest that the reform had *differential* effects among different subgroups. In addition to analyzing contributions to a curriculum's total IT, this study also analyzed the IT specifically attributed to course leadership positions (e.g., Director, Associate Director, Coordinator, or Core Planning Group) because of those instructors' particular influence on course content, structure, and personnel. Instructor subgroups were defined such that "clinicians" held a clinical degree (e.g., MD), and "surgeons" were clinicians with a departmental affiliation in one of the 14 American College of Surgeons-recognized surgical specialties.[29] Non-clinician (e.g., PhD only) instructors affiliated with surgical departments were not classified as surgeons. To account for any potential year-to-year fluctuations, the analysis averaged data from the final four iterations of the old curriculum (students beginning in Academic Year [AY]2011–2012 to AY2014-2015) into a single value. This old curriculum baseline was compared to data from the first iteration of the new curriculum (students beginning in AY2015-2016), with the chi-square test assessing for statistical differences between the two.

Interview design and recruitment

The qualitative portion of this study utilized a constructivist framework and overarching thematic analysis to move beyond reductionism or theory verification to theory generation. The research team did not want to limit participants to selection of prespecified options and sought to capture the full range of participants' perceptions and priorities. Surgical faculty from HMS-affiliated hospitals participated in semi-structured interviews exploring their perspectives on current surgeon involvement in the HMS preclinical curriculum, as well as potential barriers or facilitators to further surgeon involvement in early medical school education. The Harvard University Institutional Review Board approved this study (Protocol 2018P000166).

The interview guide was developed by R.P., a surgical faculty member with expertise in medical education research, and M.K., a medical student with training in qualitative research methods, and pilot tested on surgeon volunteers. It included a standard introduction before questions on participants' prior involvement in teaching, thoughts on the role of educators, perceived barriers to their involvement in the preclerkship phase, and attitudes on promoting the field of surgery. Data from the quantitative portion of the study were provided during each interview to prompt further discussion. Participants were invited to share thoughts that were not specifically addressed in the guide and asked follow-up questions when appropriate.

A representative sample of surgical faculty at HMS-affiliated hospitals (Beth Israel Deaconess Hospital, Brigham and Women's Hospital, Children's Hospital Boston, Massachusetts Eye and Ear Infirmary, Massachusetts General Hospital, Mt. Auburn Hospital) were recruited via email. Purposive and snowball sampling were used to maximize participant perspective variability. Recruitment continued until data saturation was reached. M.K. conducted all interviews between May 2018 and July 2019. Interviews were audio recorded, transcribed with assistance from online software (www.temi.com), and manually edited to remove identifying information. All transcripts were included in the analysis.

Qualitative data analysis

M.K. and K.J., a surgical resident with training in qualitative research methods, independently read all transcripts and inductively generated approximately 220 primary codes representing specific concepts. Those primary codes were then iteratively refined and grouped into a codebook of 22 secondary codes representing broader idea categories. The authors then recoded all transcripts using this codebook, first independently and then resolving discrepancies via the constant comparative method.[30] At the end of the analysis, Cohen's kappa across all codes averaged over 0.75, indicating excellent inter-coder reliability.[31] Trends and relationships among the codes were analyzed to reveal broader themes.[30] Example quotations for each code were amended for clarity when necessary but reviewed by two research team members to ensure they remained true to their original meaning. NVivo software (QSR International) was used to organize data analysis. Member checking included providing a draft of the manuscript to participants to ensure validity and trustworthiness of our interpretations.

Results

Demographics of preclinical faculty

Total IT in the preclinical period decreased from a mean of 13,728 h (range = 12,868 to 14,225 h) over two traditional academic years in the old curriculum to 10,397 h over 14 consecutive months in the new one. Clinicians provided the majority of total IT in both curricula (Fig. 1). Internal medicine was the most represented clinical specialty, with their proportion of total IT increasing from 31.1% to 43.2% across the reform. The proportion from surgeons of all types decreased from 9.9% to 5.0% (Table 1). Surgical instructors in the old curriculum represented general surgery, obstetrics/gynecology, orthopedics, ophthalmology, otolaryngology, neurosurgery, and oral and maxillofacial surgery; in the new curriculum, several of those surgical subspecialties lost representation. Although clinicians provided the majority of course leadership both before (75.4%) and even more so after the curriculum reform (94.8%), the amount of course leadership contributed by surgeons fell from 2.6% in the old curriculum (mostly accounted for by the Section Director role for the "Orthopedics" system block, as well as a few smaller Coordinator roles for the clinical skills course) to 0% in the new one.

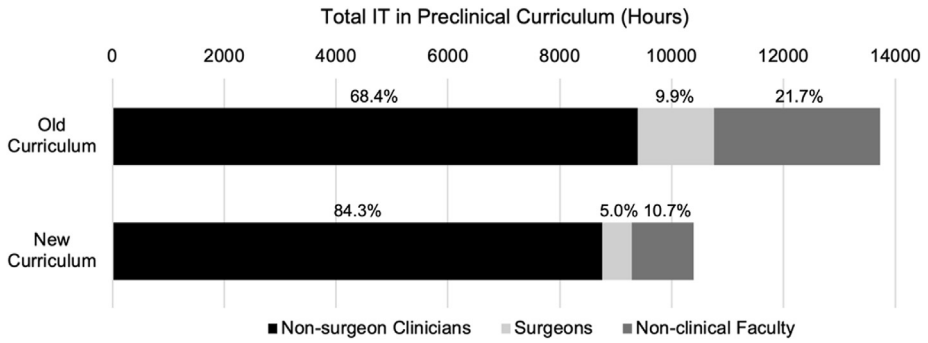

Fig. 1. Contributions to preclinical instruction by various faculty subgroups. Total IT in the preclinical period decreased from 13,728 h across two academic years in the old curriculum to 10,397 h over 14 consecutive months in the new one. The total IT from surgeons decreased from 1365–520 h.

Interview participant characteristics

Surgeon educators with teaching or administrative positions within the medical school were interviewed to explore this decrease in surgeon involvement. Data saturation was achieved after 13 interviews (12 in-person and one via telephone); transcripts ranged from 18 to 58 min (mean 39 min). Participants varied in gender, surgical subspecialty, institution, career progress, and involvement with medical education, including prior preclinical instructional activities (Table 2). Of those with student teaching positions, some actively sought the positions themselves, while others came to them following invitations or requests from colleagues. Despite this diversity in experience and background, participants were largely in agreement on the majority of issues.

Perceptions of the situation

There was a widespread perception that there are a low number of surgical faculty among the instructors in the preclinical curriculum and a small amount of surgical content in the material students are taught. Participants discussed a discrepancy between surgeon and non-surgeon involvement even before data from the quantitative part of this study were shared with them, and most participants remarked they were not surprised once they did hear the quantitative results. However, this low level of participation does not indicate lack of desire among their colleagues: "I don't think it has to do with interest. I mean, I think that many, many [surgeons] would want to be involved." While every surgeon had their own motivations for teaching, their primary motivation for participating in this project was to help students: "There's no hidden agenda except for how we can make it a better experience." In all, their comments coalesced around three domains: their own practices, the medical school community, and medical students. Imbalances between barriers and motivating or facilitating factors in each domain surfaced as key themes. The barriers both contribute to and are further reinforced by limited surgeon involvement (Table 3). Surgeons also identified a number of potential solutions.

Table 1
Percent of total IT in preclinical curriculum contributed by clinicians. Surgeons' contributions to preclinical instruction fell by half across the curriculum reform, while internists and pediatricians took on greater contributions.

Instructor Specialty	Old Curriculum	New Curriculum
Internal Medicine	31.1	43.2[a]
Pathology	10.1	5.4[a]
Surgery (any specialty)	9.9	5.0[a]
General Surgery	4.7	3.3[a]
Obstetrics/Gynecology	2.2	1.6[a]
Orthopedics	1.8	0.0[a]
Ophthalmology	0.9	0.1[a]
Otolaryngology	0.3	0.0[a]
Neurosurgery	<0.1	<0.1
Oromaxillofacial	<0.1	0.0
Pediatrics	6.3	13.8[a]
Neurology	6.3	4.8[a]
Anesthesia	3.3	1.2[a]
Psychiatry	2.3	2.6
Dermatology	1.7	3.0[a]
Radiology	0.6	1.0[a]
Emergency Medicine	0.5	3.0[a]
Other	6.3	6.3
Overall	78.4	89.3[a]

[a] Statistically significant, all $p < 0.01$.

Surgeon-level barriers: "time and money"

Many surgeons recounted the joy that teaching brings them and shared how passionate they were about the educational work they do. While participants realized that not all surgeons may feel similarly, they believed the majority of their surgical colleagues truly enjoyed teaching, and that teaching was a major reason why they pursued academic medical careers.

Unfortunately, surgeon participants felt that these desires to teach were overshadowed by several competing interests intrinsic to their work situations. One barrier cited by all participants was the demand for clinical productivity and reimbursement: "Surgeons get paid by seeing patients and doing procedures." Even if their preclinical teaching is compensated, the rate is far lower than what it would be for their primary activities. Similarly, many surgeons cited administrative duties or scholarly work leading to time constraints that prevented further involvement in preclinical education. Even though HMS has a promotion track in "Teaching and Educational Leadership," its criteria are not fully supportive:

> But even in that track, you still need to publish… If you're a clinician-educator, you're not going to be publishing as much, right? Because you're spending all this time teaching.

Many also expressed concerns that time spent on these various competing professional commitments occurs at the expense of their personal lives.

Another barrier in this theme was the logistics of scheduling. Participants felt that surgeons have less schedule flexibility than their non-surgical colleagues: "You're given hours: your block time is Tuesday; Wednesday is your clinic time. And especially at bigger places … they have to be rigid." Several cited times when they had to turn down teaching opportunities because the timing was

Table 2
Demographics of interview participants. A combination of purposive and snowball sampling ensured participants varied in gender, surgical subspecialty, institution, and career progress.

Participant Demographics	Frequency (%)
Gender	
Male	10 (77)
Female	3 (23)
Surgical subspecialties	
Trauma and Critical Care	3 (23)
Cardiac	2 (15)
Endocrine	2 (15)
Pediatric	2 (15)
Breast	1 (8)
Obstetrics/Gynecology	1 (8)
Ophthalmology	1 (8)
Plastic	1 (8)
Institution	
Brigham and Women's Hospital (793-bed teaching hospital)	5 (38)
Boston Children's Hospital (404-bed pediatric hospital)	3 (23)
Beth Israel Deaconess Medical Center (651-bed teaching hospital)	2 (15)
Massachusetts Eye and Ear Infirmary (41-bed specialty center)	1 (8)
Massachusetts General Hospital (999-bed teaching hospital)	1 (8)
Mount Auburn Hospital (213-bed teaching hospital)	1 (8)
Years since residency	
Mean	19.2
Range	4–40
Years at current institution	
Mean	15.5
Range	2–38
Academic Rank	
Instructor	2 (15)
Assistant Professor	7 (54)
Associate Professor	2 (15)
Professor	2 (15)

incompatible with their clinical schedules.

Proposed solutions to surgeon-level barriers

1. Supportive incentive schemes. Participants acknowledged that the most effective solution would be to restructure payment and promotion schemes to better reflect their institution's teaching mission. While participants acknowledged that changes could pose significant challenges for department leadership, many surgeons felt it was possible. Understanding that this would not be accomplishable immediately, participants also proposed several easier-to-implement solutions that could address the problem in the meantime.
2. Engaging the right people. Participants acknowledged that some surgeons may be more interested in preclinical teaching than others. Just as some surgeons prioritize laboratory research over clinical work, so too can a subset serve as specialized instructors. Utilizing a smaller group of particularly effective teachers may be an efficient way to ensure students still get the quality exposure they deserve. Furthermore, some groups of surgeons may have more time and schedule availability to teach compared to others, such as senior surgeons who are reducing their clinical volume but want to remain academically engaged and research trainees with greater schedule flexibility.
3. Faculty resources. Participants suggested a variety of supports that could facilitate their teaching activities. They reflected on the benefit of material resources like simulation centers or suture kits in allowing them to do the sort of activities they want, administrative assistance regarding course communications and scheduling, and colleagues who are willing to cover their clinical duties while they were away teaching. They also proposed faculty development opportunities to help them become better teachers.

Medical school-level barriers: "knowing where we can be helpful"

Many surgeons cited camaraderie and social connections as a major motivation for the work they do. Beyond wanting to share a surgical perspective on foundational medical knowledge domains that are relevant to all students, interviewees also hoped their involvement as teachers could model the collaboration that exists among specialties in the clinical setting.

However, many participants cited a lack of connection between surgeons and non-surgeon educators as a major barrier to their getting or staying involved with teaching. One surgeon who previously taught preclinical medical students remarked how a lack of support or feedback from other faculty led to his voluntary disengagement. Some participants had the sense that the medical school contained a core of preclinical teaching faculty from non-surgical specialties and that the few surgeons on the periphery "don't want to rock the boat."

Surgeons discussed how their lack of representation among course leadership, who are primarily responsible for determining course structure and content, as well as recruiting other faculty, has resulted in increasingly disadvantageous curricular design decisions: "It's become more and more exclusionary to surgeons." A majority of participants expressed poor familiarity with the new preclinical curriculum, and some wondered if their lack of input in its design meant less surgical content and even fewer opportunities for them to teach. Even if those opportunities exist, the surgeons are not hearing about them. One surgeon suspected that the non-surgeon course directors did not invite him because of their belief that he "wouldn't show up" due to the occasionally unpredictable nature of his clinical work. Even if surgeons wanted to teach, the net result of this disconnect is not knowing where or how they can get started.

Several interviewees felt that this disconnect is common among

Table 3
Theme development. Included below each section heading are the final codes encompassed in that theme, the frequency with which those codes appeared in the 13 transcripts, and representative quotations.

Themes, Codes, and Example Quotations	Frequency (%)
Perceptions of the quantitative results	
Low surgical representation in the preclinical curriculum	12 (92)
"I would say like 95% of surgical training comes from the rotations, so there's nothing from class … nothing like that."	
"In ob/gyn, anyways, there's very little in the preclerkship curriculum, in terms of reproductive physiology, maternal-fetal stuff, pregnancy … and we're really not tapped into."	
Sufficient interest among surgical faculty	11 (85)
"Anything that goes back to the leadership should emphasize the fact that surgeons actually do want to be involved. We have reasons why we're not, but it's not related to a lack of interest in participating."	
Striving to make a better educational experience	7 (54)
"The education that we as ophthalmologists are providing to our colleagues is subpar, and that's why I'm annoyed by the type of consults we're getting. And then stepping back and looking and saying, 'Look, it's not their fault; it's my fault.' I didn't teach them properly, or I didn't have the opportunity to teach them."	
Surgeon Factors	
Competing interests	13 (100)
"With all of the current focus on trying to be economically viable and making sure you're generating enough revenues and cases and all that sort of stuff, I think it's easy to lose track of that teaching-educational mission"	
"The medical school has some compensation for the core course instructors … But it's sort of de minimis as compared to doing an operation."	
Being in academic medicine	11 (85)
"Faculty go to these academic centers for many reasons, but one of them is the opportunity to participate in the education experience of residents, fellows and certainly the students in a real meaningful way."	
"Everyone always thinks of innovation, research, certainly, but number one reason for academia is teaching and education. I think that is also a clear choice that people make, so should be an integral part [of what you] do."	
Challenging schedule logistics	10 (77)
"In internal medicine and some of the other medical subspecialties, the clinicians tend to have solid months when they're on service … and then there are others, where they're off. And that's quite different from a surgeon's practice, where it's very hard for a surgeon to say, 'I'm just going to take this month off.'"	
"If they said, 'Well, could you teach in whatever course—pathophysiology? And we meet on Tuesday mornings, and you'd have to be there from 9 to 12.' It would be impossible if it would be my block time or my clinic day. I wouldn't even be able to do it because I have no flexibility."	
Teaching is intrinsically enjoyable	10 (77)
"If you're really passionate about what you're doing, you have an interest, intrinsic, innate desire, passion to share it."	
"There is something really satisfying about meeting someone really early in their training then following them through. I've been to graduation several times, and I'm very proud to see people progress. That's really cool."	
Providing adequate supports to faculty	10 (77)
"I don't know if I'm good [at teaching] or not, but I found that I liked it, and people have helped me, promoted me, and I've gone to a lot of the stuff that has gone on at the [Harvard Medical School] Academy here, which teaches you how to teach."	
Finding the right people to teach	9 (69)
"The ability for me to spend time and effort and energy on this teaching stuff is really only now possible because [as I've become more senior] I've really reduced my clinical time... I think this might actually represent a pool of talent that could be pulled into the medical school."	
"I am in the research environment now. There are like myself other surgical residents and surgical trainees, either from the US or abroad, that are taking one year off to do research, and they have a little bit more flexible time."	
Medical School Factors	
Faculty social connections and invitations	12 (92)
"If we don't have a lot of in-roads already with, let's say, the dean of the curriculum, or whoever is the person that makes the curriculum, they don't think of us."	
"Invite us to these things! Just because we've said no in the past doesn't mean that we should stop getting the invites."	
Teaching all students foundational skills	10 (77)
"Because most people that come through are not going to be surgeons. And that's fine. But you got to speak the language of the surgeon. You're going to call consults, you're going to have patients with surgical problems or postop patients who come back to see you. And if you don't understand the basics of what happens to those patients when you send them off into the world for surgery, and then they come back, you'll have a huge gap in your knowledge."	
Bureaucracy and institutional inertia	10 (77)
"Because we've got several hospitals affiliated with HMS, and they all have different personalities and different structures and different leaderships. So at a place where there's a single institution, one affiliated hospital, it is very easy for the two to agree on things."	
Thinking outside the box	10 (77)
"Some of the older surgeons may be resistant about doing video lectures and would want to do in-person, but I think it's where we're heading, and I think it would increase flexibility."	
Low familiarity with curriculum	8 (62)
"I don't know how the first year works, what the curriculum entails, what the classes are like. I still don't know what they do in anatomy and how they learn anatomy. So not knowing how the preclinical years are structured, it's also hard to know, is there anything out there that we can help with?"	
Surgeons excluded from the curricular redesign process	7 (54)
"I think surgeons are very uninvolved in the curriculum designing process. As far as I know. I've never been asked to participate in any of those meetings, or nobody ever even asks what I thought about the curriculum and the design of it."	
Student Factors	
Wanting to advance the field of surgery	12 (92)
"We want to keep attracting bright, talented people into the specialty because that's how our specialty is going to grow and thrive, then make a contribution to people's health. […] We need bright people who can make a contribution to be standing on our shoulders the way we stood on our predecessors' shoulders and keep trying to advance the field."	
Early experiences having later impacts	12 (92)
"Meeting students in the clinical years that I've known from the preclinical class is really pretty neat, and I think it's good on both sides. […] It enhances that experience if you're familiar with that student from before, you're more likely to trust them with clinical things, which they really like and that enhances their experience as well."	
Presenting a realistic view of surgery	10 (77)
"It's really hard to envision what a medical career looks like unless you have intimately known somebody, like a family member... Who are the patients that you see? What type of surgeries do you do? Those are all really variable among surgeons … And you wouldn't ever know any of those nuanced things unless you're having a conversation with them."	
Students' biased views about surgery	8 (62)
"Some of those biases that students have already coming into their clinical years of surgery. You know, they already come in thinking, 'Surgeons are just arrogant and mean and, and rushed and impatient.' […] I think that's because they haven't had that interaction. That's what you see on TV."	
Demand among students	8 (62)
"When I meet with students at that [early] stage, they are very excited to meet clinicians and actual practicing surgeons."	
"They gave us a little card at the end of [the course]. There was more than one student who wrote how interesting and important it was (or words to that effect) to have the surgical perspective on things."	
Students' limited interest in surgical careers	6 (46)
"I have had the perception, and I think the data would support, that a smaller number of Harvard Medical Students are going into surgical disciplines."	
"I think the number [of students interested in surgery] is small. I don't know if that's related to their curriculum, or is it related to the students that come through HMS or, or what. But it's probably a combination."	
Establishing structured teaching experiences for all students	6 (46)
"I like seeing [students who are open minded about their career choices]. Otherwise we're just preaching to the choir, and the people that are dyed-in-the-wool surgeons from the day they were born, if we don't have some contact also with the ones who aren't committed."	

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all medical schools and not unique to our local context; however, a few suggested the problem is exacerbated by the "decentralized and hospital-based" organizational structure at HMS, compared to other medical schools with a single teaching hospital.

Proposed solutions to medical school-level barriers

1. Invitations to teach. Nearly all surgeons spoke favorably about invitations informing them of opportunities to teach. Such requests are especially important given the many other demands they are facing: "You cannot rely on people that just want to do it because they think it's important. You need to remind these people that it is important." Given the constraints on surgeons' schedules, participants advised that invitations should arrive with several months of advanced notice; requests with short notices or limited options are not only impossible for them to accommodate, but perhaps even regarded as counterproductive to bridging the perceived social divide.
2. Curriculum familiarity. Going further, helping surgical faculty better understand when and how students are learning surgical topics would allow them to proactively identify opportunities to teach about their clinical focus that might not currently exist. One surgeon envisioned an orientation for all new faculty members explaining the entire medical school curriculum and the types of available teaching opportunities as a broad overview, as well as continued access to a keyword-searchable database including all syllabi and other course materials for more specific inquiries.
3. Thinking outside the box. Because many existing teaching roles employed in the new curriculum (such as small-group facilitator roles that require daily participation for weeks at a time) are not feasible for most surgeons, participants discussed the need to creatively find other ways to include them. Teaching arrangements for which the surgeons contributed in the past include workshops in the evenings or during periodic elective weeks. Additionally, the HMS curriculum's flipped-classroom format features preparatory videos that students review before in-class sessions. Surgeons could help create these videos as a means of reaching students without the constraints of attending in-person classroom activities.

Student-level barriers: "skewed and biased views"

Surgeons expressed a strong desire to advance the field by inspiring students to become surgeons themselves: "We want to keep attracting bright, talented people into the specialty because that's how our specialty is going to grow and thrive." Many participants related their career trajectories to significant memories they had with their own surgical mentors, and how those relationships usually arose early in their training, and often in unexpected ways: "And you never know when those formative experiences are going to occur, and the fact that we're not exposing students more to this field, I feel like that's a missed opportunity."

However, such aspirations are often challenged by "skewed and biased views" among students. According to one participant, "They already come in thinking, 'Oh, you know, surgeons are just arrogant and mean and rushed and impatient.'" Another articulated how those attitudes might place surgical educators under harsher scrutiny than other clinicians: "You're fighting an uphill battle … You have to prove to them that you're not a bad surgeon and not a bad role model." One said how connecting with students is even more challenging when students lack the fund of surgical content knowledge necessary to teach them in the way he would hope.

Surgeons felt that these negative stereotypes are widespread and longstanding in society, introduced by the media or students' families and persisting because of their limited firsthand exposure. They wonder if such views contribute to a low level of interest among HMS students in pursuing surgical careers. As such, they cite dispelling myths as a motivation to get involved. Participants acknowledged that surgery can be a difficult path and is not appropriate for all students, so it is important to present "a realistic but a balanced view" of their work.

Proposed solutions to student-level barriers

1. Structured early experiences. Participants recognized that students' exposure to surgeons in the preclinical period currently occurs primarily through extracurricular interest group events. To avoid the previously discussed selection biases, surgeons found it important to participate in "structured classroom experiences where everybody in the class sees this ob/gyn or general surgery teacher, role model, and wants to learn more." Embedding surgeons and surgical content into the core curriculum would ensure all students have similar opportunities to learn about surgery and further legitimize the field as a critical component of all medical students' education.
2. Coordinated approach. Because extracurricular or elective events are often inconsistent and fragmented, one participant discussed the utility of developing an overarching approach to surgical education that spans the entire curriculum. Designating and adequately supporting one person to oversee and coordinate all surgical education components would both offload some of the demands currently placed on individual surgical faculty members to identify gaps in the curriculum and avoid the diffusion of responsibility to include those topics that currently exists among the other non-surgeon course directors. Having a clear point-person would also help to address surgeons' perceived disconnect with other preclinical faculty.
3. Leveraging student voice. Many participants noted that even if students harbor negative views about surgeons *before* direct experience, students generally received their teaching very positively and expressed an interest in further surgeon involvement. Participants highlighted a need to share the students' positive feedback to demonstrate that such efforts are worthwhile: "It's extremely important for the students to organize and say, *demand* from the course directors and the faculty in the school to get more surgeons involved."

Discussion

Curricular changes are an expected part of the life cycle of any medical school program. However, as content is added, our concern is that surgeons are losing their seat at the table to shape these curricula in a manner that ensures adequate surgeon participation and exposure. This study examines the demographics of the educators in a medical school's preclinical curricula before and after a major curriculum reform. There was a significant decrease in surgeon involvement from 10% prior to the reform to 5% afterwards, in addition to a complete loss of course leadership roles. In seeking to explain why this lack of surgeon involvement exists in the preclinical period, qualitative data highlighted imbalances between barriers and facilitating factors in three domains: the surgeons' own practices, the medical school community, and medical students. All of these barriers likely affected surgeons' ability to teach before the curriculum reform, but programmatic changes may have "tipped the scales" and worsened the imbalances. To address the barriers, surgeons offered associated potential solutions. A unifying feature throughout the solutions is a need for deliberate efforts to disrupt the reinforcing dynamics that exist between the barriers and limited involvement (Fig. 2).

Because the themes are interrelated, attempts to address barriers in one domain may also alleviate the others. Their scope underscores the cooperation of multiple stakeholders including surgeons, surgery departmental leadership, course directors,

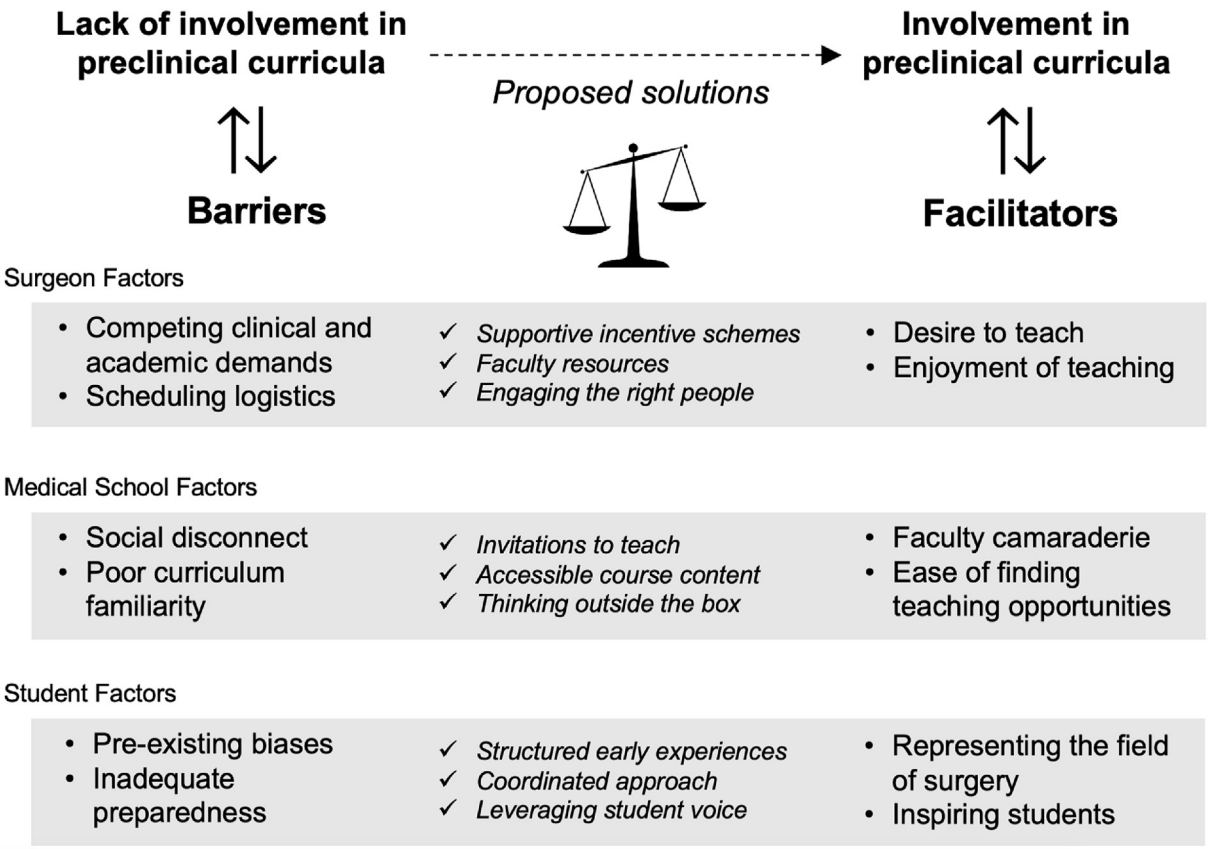

Fig. 2. Factors influencing surgeons' involvement in preclinical curricula. A progressive imbalance between barriers and motivating or facilitating factors in multiple domains has resulted in decreasing levels of involvement. The bidirectional arrows indicate how a lack of involvement itself reinforces the barriers, while positive teaching experiences reinforce the facilitators. Also included are interventions proposed by the surgeons that can address the barriers and potentially shift the imbalance to promote surgeon involvement.

medical school administrators, and students. Previous research demonstrates that even small increases in pre-clinical faculty exposure can positively affect medical student career interests. For example, after the University of Pittsburgh revised its preclinical curriculum to include more exposure to radiology through dedicated lectures and consult sessions in problem-based learning activities, students had higher interest in radiology as a discipline and more favorable opinions of radiologists, both immediately after their exposure and persisting until graduation.[32,33]

Perhaps some of the most influential interventions would be restructuring reimbursement and promotion criteria. Dr. LeMaire and colleagues described the development of an "academic relative value unit" system to incentivize activities contributing to the research- and education-related aspects of the Baylor College of Medicine's overall mission. A new reporting system and bonus payment model may have contributed to increases in several academic achievement metrics for Surgery Department faculty.[34] The activities to be rewarded in such a program should reflect the AAMC Group on Education Affairs' "Q^2Engage" model recognizing the quantity and quality of education-related contributions, including direct teaching, the development of curricular materials, and course leadership.[35] To help recognize roles that might otherwise be overlooked or undervalued, researchers at the University of Toronto catalogued all medical student teaching activities and assigned each an "effort score" based on the required level of investment.[36]

This study had several limitations. The quantitative data described only the first iteration of the new curriculum, which may change over time. Although the proportion of total IT might not fully capture an instructor's involvement, this metric reflects curricular contributions more robustly than others, such as the proportion of appointments held, because appointments varied greatly in their ascribed ITs. The goal of this paper was not to advocate for a specific proportion of instruction by surgeons, but for curricular designers to consider it as a relevant metric.

The motivations and barriers to medical student teaching identified in our institution are similar to those that have been previously identified for surgeons at other institutions.[2,3,37,38] Furthermore, the findings mirror barriers found in investigations among other clinical specialties. A study of General Practitioners in the United Kingdom invoked the "Communities of Practice" theory, which argues clinical educators must balance identities and belonging to both clinical practice and teaching communities.[39] As such, the solutions proposed here may apply to other clinical specialties and educator groups that suffer from marginalization and biased preconceptions among students. Future research should examine the impact of curricular reforms on the demographic composition of preclinical faculty and the longitudinal effect of early role models on students' subsequent perceptions, clinical experiences, and career trajectories.

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