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The Philadelphia surgery conference: a value analysis of a hands-on surgical skill-building event.

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Medical Education Original Article

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Abstract

Context: Limited opportunities exist to practice technical skills and to be exposed to various surgical specialties during preclinical medical education.
Objectives: To assess the value of workshop-based educational opportunities to medical students during preclinical training.
Methods: One hundred and 75 medical and physician assistant students from 10 medical schools attended the 2019 Philadelphia Surgery Conference. All students received STOP THE BLEED® bleeding control training and participated in four workshops, chosen from a list of 23, that demonstrated a variety of surgical skills. Data collection was accomplished using both a pre- and postconference survey to assess changes in confidence of personal capabilities, knowledge base, and opinions regarding preclinical medical training.
Results: Preconference survey results indicated low baseline confidence in personal surgical skills (mean [SD], 1.9 [1.0], on a Likert scale of 1–5), and knowledge of various surgical specialties (2.7 [1.0]). Students highly valued skill-building experiences (mean [SD], 4.2 [1.1]) and face-to-face interactions with resident and attending physicians (4.4 [0.9]). Postconference survey analysis demonstrated increased confidence in surgical ability by 52.6% (mean [SD], 2.9 [1.0]; p<0.001) and knowledge base by 34.6% (3.5 [0.8]; p<0.001). Value scores increased for both preclinical surgical skill-building opportunities (mean [SD], 4.4 [0.9]; p=0.014) and interactions with resident and attending physicians (4.7 [0.6]; p=0.002).
Conclusions: The Philadelphia Surgery Conference provided a highly valuable experience to participating students, increasing confidence in personal knowledge base and surgical skills while facilitating a collaboration between students and resident and attending physicians from various surgical specialties.

Keywords: collaboration; conference; medical education; mentorship; surgery; surgical skills.

Surgery traditionally has been regarded as a popular and competitive specialty. However, medical students with an interest in a surgical career face many challenges in obtaining appropriate surgical educational opportunities, especially in the preclinical years. Preclinical medical school curriculum, which includes anatomy and pathology courses, has become more focused to cater to students of varying interests. Furthermore, any surgical teaching is limited to core concepts and surgical emergencies, with limited coverage of the differing subspecialties and the procedural skills intrinsic to each [1].

Up to 45% of first-year medical students rank surgery as one of their top three career choices; however, there is a decline in interest in a surgical career at a rate of 5% per year, culminating in a match rate of only 7% [2]. Efforts outside the classroom are necessary to attract students and maintain their interest in surgery, providing opportunities to explore the field. Surgical interest clubs are among the most proactive and successful forums for the recruitment of preclinical medical students [3]. However, opportunities for surgeons to directly interact with medical students in an academic, hands-on, workshop-based setting are limited.

Furthermore, in 2020, the Accreditation Council for Graduate Medical Education (ACGME), Association of

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American Colleges of Osteopathic Medicine (AACOM), and the American Osteopathic Association (AOA) completed the implementation of a single graduate medical education (GME) accreditation system for all residency programs in the United States. Among other intentions, this unification process was designed to offer all US medical school graduates a uniform GME pathway [4]. All fourth-year medical students, both osteopathic physicians (DO) and allopathic physicians (MD), were included in the 2019–2020 residency match and applied to the same set of residency programs accredited by a single body. As these changes unfolded, the importance of interprofessional collaboration between students from different clinical training programs had the potential to become a higher priority in medical education.

The Philadelphia Surgery Conference provides an annual opportunity for students to explore their surgical interests, develop surgical skills, interact with mentors in their desired surgical field of interest, and collaborate with students from other clinical training programs. This study aimed to assess the subjective value of hands-on, workshop-based surgical skills training, mentorship, and interprofessional interactions for preclinical medical students and physician assistants interested in pursuing a surgical career.

Methods

Design, setting, and participants

The 2019 Philadelphia Surgery Conference was held on January 19, 2019 at the Philadelphia College of Osteopathic Medicine (PCOM) campus by PCOM's student-run surgery interest group, Wisely Surgical Association. Students were recruited from the following medical schools to participate: PCOM, PCOM-Georgia, Perelman School of Medicine at the University of Pennsylvania, Drexel University College of Medicine, Lewis Katz School of Medicine, Rowan University School of Osteopathic Medicine, Cooper Medical School of Rowan University, Geisinger Commonwealth School of Medicine, Lake Erie College of Osteopathic Medicine, and Touro College of Osteopathic Medicine. Recruitment was accomplished electronically via email correspondence. The President of each school's surgery interest group was emailed with a link to the conference website, which provided registration, advertisement, and information about the conference. Attendance in each workshop was limited during the registration period to ensure that the students participating in a cadaver-based procedure, electronic/robotic simulation, or technical skill-building clinic could be as hands-on as possible.

Introductions began with a keynote address on the topic of leadership given by a DO attending physician and medical director of trauma and critical care. The keynote address at the conference was given by a physician who was not involved in the study or authorship of this manuscript. The day's events commenced with an STOP THE BLEED® certification workshop, a national bleeding control initiative [5]. Students were asked to choose four, 1-h workshops from a list of 23 that explored a variety of surgical procedures (Table 1): two workshops following the STOP THE BLEED® certification workshop and two workshops after lunch. Attending and resident physicians (both osteopathic and allopathic) were recruited to lead these workshops and demonstrate the procedures while enlisting the help of the students. During the lunch hour, attending and resident physicians were invited as guest speakers to present on their surgical subspecialty to preregistered subgroups of students (Table 1). The conference day concluded with a personal perspective that highlighted initiative and selfless service practiced in international communities by an MD pediatric orthopedic surgeon and global surgery specialist.

Data collection and definitions

Institutional Review Board approval was given by the Philadelphia College of Osteopathic Medicine (Protocol #H19-046X). Informed consent was obtained during the opening and closing remarks of the conference, addressing all participants in attendance. A pre- and postconference survey were distributed to each participant in paper format at the beginning and end of the conference, respectively. The preconference survey was completed before the start of events on the day of the conference, and the postconference survey was completed at the conclusion of the conference. Each preconference survey was given an identification number matching that of a postconference survey to maintain confidentiality and allow for data analysis comparing pre- and postevent responses. Some students did not complete the surveys at the beginning or end of the conference.

The preconference questionnaire gathered demographic data, including sex, age, school, program, and year in program. Further questions were included to assess prior general clinical exposure to surgery both before and during medical school, prior clinical exposure to the specific desired surgical specialty of interest, activity in the surgery interest group at the respondent's school, exposure to surgical training/events at the respondent's school, exposure to surgical simulation opportunities, whether the respondent had a mentor in their desired surgical field of interest, whether the respondent had performed research in a surgical field, and whether the respondent had attended a prior surgical conference. Answers to these questions were completed using a Likert scale from 1 to 5, with 1 being "completely disagree," 2 being "somewhat disagree," 3 being "neutral," 4 being "somewhat agree," and 5 being "completely agree." A variety of scales to subjectively assess participants' confidence in their surgical knowledge and skills, and opinions regarding the importance of hands-on experiences and interactions with attending/resident physicians, were included. Answers to these questions were also completed using a Likert-type scale from 1 to 5, with 1 being "none/not at all," 2 being "minimally," 3 being "neutral," 4 being "moderately," and 5 being "highly."

The postconference questionnaire included the same confidence and value scales as the preconference survey to assess changes in subjective scores following the event. Further, the postconference survey assessed participants' likelihood of attending future surgery conferences in medical school or volunteering to run events for other medical students during/after resident training, whether the conference changed the respondent's perception of osteopathic surgeons, whether the respondent would attend the following year's conference, and how valuable the respondent considered collaboration with students from other medical schools. Answers to these questions were completed using a Likert-type scale from 1 to 5, with 1 being "none/not at all," 2 being "minimally," 3 being "neutral," 4 being "moderately," and 5 being "highly."

Table 1: 2019 Philadelphia surgery conference workshop and lunch talk offerings (n=217).

Workshops	Number of students registered	Lunch presentations	Number of students registered
Technical skill-building clinic		Orthopedic surgery with a PGY5	38
Chest tubes/intubation	55 (range 12–16)	Obstetrics/gynecology with an attending physician	21
Knot-tying and suture skills	118 (range 24–35)	Neurosurgery with a program director	21
Operating room etiquette, gowning, gloving, and surgical scrubbing	45 (range 10–14)	General surgery with a PGY5	25
		Urology with an attending physician	14
Peripheral IVs and central lines	70 (range 15–20)	Otolaryngology with a PGY1 and PGY4	10
Casting and splinting	64 (range 13–21)	Cardiothoracic surgery with an attending physician	30
Ultrasound training: FAST and FATE exams	47 (range 6–15)	Plastics and reconstructive surgery with a PGY4	24
Electronic/robotic simulations		Trauma surgery, surgical critical care, and neuro-critical care with an attending physician	34
da Vinci robotic surgery simulator	23 (range 2–9)		
Neuro VR neurological training simulator	31 (range 15–16)		
Angiography	35 (range 8–11)		
Trauma cut-suit simulation	53 (range 12–17)		
Labor and delivery simulation	22 (range 11)		
Laparoscopic mentor facilitator	2 (range 1)		
Laparoscopic surgery simulator	24 (range 6)		
Cadaver-based procedures			
Total/hemi-joint arthroplasty	46 (range 10–14)		
Knee/shoulder arthroscopy	28 (range 4–8)		
Roux-en-Y gastric bypass	15 (range 15)		
Vertical sleeve gastrectomy	10 (range 10)		
Nephrectomy and urologic surgical approaches	24 (range 10–14)		
Parotid dissection	25 (range 10–15)		
Emergency thoracotomy and open cardiac massage	25 (range 10–15)		
Cadaver-based suturing and skin grafting	47 (range 10–14)		
Auricle laceration repair	30 (range 14–16)		
Burr holes, craniotomies and pedicle screws	29 (range 14–15)		

FAST, focused assessment with sonography in trauma; FATE, focus-assessed transthoracic echocardiography; IV, intravenous; PGY, postgraduate year; VR, virtual reality.

Statistical analysis

Participant demographics and survey answers were summarized using count (%) for categorical variables and by mean (standard deviation, SD) for continuous variables. Changes in measures were assessed using paired samples t tests. Significance was set at $p<0.05$, and all tests were two-sided.

Results

Participant demographics

Two hundred and 17 students registered for the 2019 Philadelphia Surgery Conference, and 175 students were in attendance. Of those in attendance, 141 participants (80.6%) were osteopathic medical students, 29 (16.6%) were allopathic medical students, and 5 (2.9%) were physician assistant (PA) students. Most students (128; 73.1%) were from the Philadelphia College of Osteopathic Medicine (PCOM) Philadelphia campus; 13 students (7.4%) were from Rowan University School of Osteopathic Medicine, 12 students (6.9%) were from Geisinger Commonwealth School of Medicine, seven students (4%) were from Drexel University College of Medicine, seven students (4%) were from Cooper Medical School of Rowan University, two students (1.1%) were from Lake Erie College of Osteopathic Medicine, two students (1.1%) were from Lewis Katz School of Medicine at Temple University, two students (1.1%) were from Touro College of Osteopathic Medicine, one student (0.6%) was from the Perelman School of Medicine at the University of Pennsylvania, and one student (0.6%) was from PCOM Georgia campus. Most students (94.3%) were either in their first or second year of medical/PA school (58.3% first year; 36.0% second year; 5.7% third year; 0.0% fourth year).

Preconference survey data

Of the 175 participants, 168 (96.0%) completed the preconference survey (Table 2). Most students (47; 28.0%) expressed a "neutral" response when asked if they had received adequate exposure to surgery from their respective medical school curriculum. More students "somewhat agree[d]" that they were active in their school's surgery club (52; 31.0%) and had received adequate exposure to surgery with extracurricular clubs (57; 33.9%).

In assessing participants' prior clinical exposure to surgery, 85 students (50.6%) had observed surgical cases, 55 (32.7%) had scrubbed into surgical cases, and 27 (16.1%) had no previous exposure to surgery. In assessing participants' prior exposure to their surgical specialty of interest, 77 students (45.8%) had observed surgical cases, 39 (23.2%) had scrubbed into surgical cases, and 51 (30.4%) had no previous exposure. Most students had never been exposed to surgical simulators (91; 54.2%), did not have a current mentor in the surgical field (111; 66.1%), had never performed research in a surgical field (124; 73.8%), and had never attended a surgery conference (133; 79.2%).

When asked to rate their confidence in their own personal surgical skills, 70 students (41.7%) reported "none/not at all." Many students (55; 32.7%) reported "neutral" confidence in their understanding of the various surgical specialties. However, students "highly" valued hands-on clinical practice (86; 51.2%), face-to-face interactions with resident and attending physicians (102; 60.7%), and the experiences in medical school (120; 71.4%) when considering a potential future career in surgery at this stage in their medical training. Responses are further detailed in Table 3.

Table 2: Participant demographic characteristics from preconference survey (n=168[a]).

Characteristic	n (%)
Sex	
Men	72 (42.9%)
Women	79 (47.0%)
Age	
18–25	107 (63.7%)
26–29	42 (25.0%)
30+	4 (2.4%)
Program	
DO	116 (69.0%)
MD	32 (19.0%)
PA	5 (3.0%)
Year in program	
First	98 (58.3%)
Second	52 (31.0%)
Third	2 (1.2%)
Fourth	0 (0.0%)

[a]Of the 168 participants who completed the preconference survey, some did not complete the preconference survey, omitting or skipping questions. Therefore, not all numbers total 168. DO, osteopathic physician; MD, allopathic physician; PA, physician assistant.

Postconference survey data

Of the 175 students who attended the conference, 89 (50.9%) completed the postconference survey after the event. When asked to rate their confidence in their own personal surgical skills after the conference, 60 students (67.4%) reported an increase, 25 (28.1%) reported no change, and two (2.2%) reported a decrease in confidence level compared to before the conference ($p<0.001$). Fifty students (56.2%) reported an increase, 29 (32.6%) reported no change, and eight (9.0%) reported a decrease in their confidence level of their understanding of the various surgical specialties ($p<0.001$). Hands-on clinical practice became more valued for 28 students (31.5%), whereas the value stayed the same for 45 students (50.6%; $p=0.014$). Face-to-face interactions with resident and attending physicians became more valued for 21 students (23.6%), whereas the value stayed the same for 59 students (66.3%; $p=0.002$). The experiences in medical school became more valued for 15 students (16.9%), whereas the value stayed the same for 61 students (68.5%) when considering a potential future career in surgery at this stage in their medical training ($p=0.470$).

Of the 18 students who initially reported no interest in pursuing a career in surgery before the conference, six (33.3%) reported an interest after the conference. Overall, 38 students (42.7%) added or removed at least one surgical specialty of interest from their initial list. Thirty-eight students (42.7%) reported a change in their perception of osteopathic surgeons after the conference. An overwhelming majority of students (84; 94.4%) confirmed an interest in attending the following year's conference.

After the conference, most students were "highly" likely to attend future surgical conferences in medical school (73; 82.0%) and volunteer to run events for medical students as residents (67; 75.3%). A majority (55; 61.8%) considered collaboration with students from other medical schools "highly" valuable. Responses are further specified in Table 4.

Discussion

Initially established in 2014, the Philadelphia Surgery Conference is a day-long workshop-based clinic designed for

Table 3: Preconference survey data (n=168).

Item	n (%)	Mean score (SD)
Do you feel that you have received adequate exposure to surgery during your medical school curriculum?		2.7 (1.2)
1 – completely disagree	33 (19.6%)	
2 – somewhat disagree	40 (23.8%)	
3 – neutral	47 (28.0%)	
4 – somewhat agree	36 (21.4%)	
5 – completely agree	10 (6.0%)	
Are you active in the surgery club at school?		3.2 (1.4)
1 – completely disagree	29 (17.3%)	
2 – somewhat disagree	19 (11.3%)	
3 – neutral	34 (20.2%)	
4 – somewhat agree	52 (31.0%)	
5 – completely agree	32 (19.0%)	
Do you feel that you have received adequate exposure to surgery with extracurricular clubs?		3.3 (1.1)
1 – completely disagree	16 (9.5%)	
2 – somewhat disagree	21 (12.5%)	
3 – neutral	49 (29.2%)	
4 – somewhat agree	57 (33.9%)	
5 – completely agree	21 (12.5%)	
How confident are you in your own personal surgical skills?		1.9 (1.0)
1 – none/not at all	70 (41.7%)	
2 – minimally	50 (29.8%)	
3 – neutral	35 (20.8%)	
4 – moderately	9 (5.4%)	
5 – highly	2 (1.2%)	
How much understanding do you have of the various surgical subspecialties?		2.7 (1.0)
1 – none/not at all	21 (12.5%)	
2 – minimally	52 (31.0%)	
3 – neutral	55 (32.7%)	
4 – moderately	33 (19.6%)	
5 – highly	3 (1.8%)	
How valuable do you consider hands-on clinical practice to be at your current stage of your medical training?		4.2 (1.1)
1 – none/not at all	5 (3.0%)	
2 – minimally	14 (8.3%)	
3 – neutral	17 (10.1%)	
4 – moderately	44 (26.2%)	
5 – highly	86 (51.2%)	
How valuable do you consider face-to-face interactions with resident and attending physicians in your desired surgical field at your current stage of your medical training?		4.4 (0.9)
1 – none/not at all	6 (3.6%)	
2 – minimally	2 (1.2%)	
3 – neutral	11 (6.5%)	
4 – moderately	43 (25.6%)	
5 – highly	102 (60.7%)	
Do you feel that experiences in medical school are important in determining future career ambitions?		4.6 (0.7)
1 – none/not at all	2 (1.2%)	
2 – minimally	1 (0.6%)	
3 – neutral	10 (6.0%)	
4 – moderately	32 (19.0%)	
5 – highly	120 (71.4%)	

Table 3: (continued)

Item	n (%)	Mean score (SD)
Do you have previous exposure to surgery?		NA
None	27 (16.1%)	
Observed	85 (50.6%)	
Scrubbed into <5 cases	22 (13.1%)	
Scrubbed into >5 cases	33 (19.6%)	
Do you have previous exposure to the surgical specialty of interest?		NA
None	51 (30.4%)	
Observed	77 (45.8%)	
Scrubbed into <5 cases	20 (11.9%)	
Scrubbed into >5 cases	19 (11.3%)	
Do you have previous exposure to surgical simulators?		NA
Yes	74 (44.0%)	
No	91 (54.2%)	
Do you have a mentor in surgery?		NA
Yes	55 (32.7%)	
No	111 (66.1%)	
Have you attended a surgery conference before?		NA
Yes	33 (19.6%)	
No	133 (79.2%)	
Have you performed research in surgery?		NA
Yes	42 (25.0%)	
No	124 (73.8%)	
Were you interested in a career in surgery before the conference?		NA
Yes	140 (83.3%)	
No	18 (10.7%)	

NA, not applicable.

professional students interested in pursuing a career in surgery. This event has matured each year since its inception to become one of the largest student-run academic events in the country. The conference has four intentions: to broaden interest in surgical career opportunities, cultivate clinical surgical skills, facilitate interactions with resident and attending physicians, and collaborate with medical counterparts. This study aimed to assess the subjective value of this event for preclinical medical students and physician assistants interested in pursuing a surgical career.

Broadening interest in surgical career opportunities

For first- and second- year medical students, there are limited chances to explore the vast majority of surgical disciplines. Apart from the occasional lectures dispersed throughout the didactic portion of the medical school curriculum and infrequent opportunities to shadow, exposure to surgery is not as readily available until the clinical years. Surgical interest clubs provide one of the most proactive and successful forums for recruitment of preclinical medical students [3]. A significant portion of students either completely or somewhat disagreed (19.6% "completely disagree"; 23.8% "somewhat disagree") that they received adequate exposure to surgery from their respective medical school curriculum; a large percentage of students reported receiving exposure instead from extracurricular clubs (33.9% "somewhat agree"; 12.5% "completely agree") (Table 3). In the current study, many students (16.1%) did not have any clinical exposure to surgical cases and 30.4% not have any clinical exposure to their specialty of interest. This lack of experience is accentuated with the concomitant lack of exposure to surgical simulators (54.2%), mentors (66.1%), research (73.8%), and conferences (79.2%).

Past literature [6–8] has reported a decline in interest in a surgical career at a rate of 5% per year throughout medical school. Students are often deterred from choosing a surgical specialty as a career choice due to perceptions of inadequate leisure and personal time, inadequate income for level of commitment, irregularity of schedule, quantity and intensity of work, high stress level, and lack of accommodations for women [7, 8]. Early exposure to positive role models is critical for attracting and maintaining students' interest in surgery through exposure of the humanistic values of

Table 4: Postconference survey data (n=89).

Item	n (%)	Mean score (SD)	Change in score, %	p-value
After attending the conference, how confident are you in your own personal surgical skills?		2.9 (1.0)	+52.6	p<0.001
Score increased	60 (67.4)			
Score stayed the same	25 (28.1)			
Score decreased	2 (2.2)			
After attending the conference, how much understanding do you have of the various surgical subspecialties?		3.5 (0.8)	+34.6	p<0.001
Score increased	50 (56.2)			
Score stayed the same	29 (32.6)			
Score decreased	8 (9.0)			
After attending the conference, how valuable do you consider hands-on clinical practice to be at your current stage of your medical training?		4.4 (0.9)	+7.3	p=0.014
Score increased	28 (31.5)			
Score stayed the same	45 (50.6)			
Score decreased	12 (13.5)			
After attending the conference, how valuable do you consider face-to-face interaction with resident and attending physicians in your desired surgical field at your current stage of your medical training?		4.7 (0.6)	+9.3	p=0.002
Score increased	21 (23.6)			
Score stayed the same	59 (66.3)			
Score decreased	5 (5.6)			
Do you feel that experiences in medical school are important in determining future career ambitions?		4.7 (0.7)	+4.4	p=0.470
Score increased	15 (16.9)			
Score stayed the same	61 (68.5)			
Score decreased	10 (11.2)			
How likely are you to attend future conferences/symposia while still in medical school?		4.8 (0.4)	–	–
1 – none/not at all	0 (0.0)			
2 – minimally	0 (0.0)			
3 – neutral	1 (1.1)			
4 – moderately	13 (14.6)			
5 – highly	73 (82.0)			
How likely are you to participate in future educational events for students once you are finished with your medical training?		4.7 (0.5)	–	–
1 – none/not at all	0 (0.0)			
2 – minimally	0 (0.0)			
3 – neutral	2 (2.2)			
4 – moderately	19 (21.3)			
5 – highly	67 (75.3)			
How valuable do you consider collaboration with students from other medical schools and programs outside of your own?		4.4 (0.9)	–	–
1 – none/not at all	1 (1.1)			
2 – minimally	3 (3.4)			
3 – neutral	10 (11.2)			
4 – moderately	19 (21.3)			
5 – highly	67 (75.3)			
After attending the conference, are you still interested in a career in surgery?		–	–	–
Yes	84 (94.4)			
No	2 (2.2)			
Did participation in this conference alter your views of osteopathic surgeons?		–	–	–
Yes	38 (42.7)			
No	50 (56.2)			
If available, would you attend next year's Philadelphia surgery conference?		–	–	–
Yes	84 (94.4)			
No	3 (3.4)			

surgery, encouragement, and the opportunities for shadowing and research [3, 7, 8]. Following the conference, six of the 18 students (33.3%) in the current study who were not previously interested in surgery gained interest in pursuing a career in surgery after attending the conference. No students in this study reported losing interest in pursuing surgery following the event. Further, more than a third of students (37.1%) changed their surgical specialty of interest after exposure to the various surgical subspecialties.

Kassam et al. [6] found that students who were interested in surgery reported lower emotional exhaustion and higher personal achievement scores at the completion of their surgery clerkship rotation, compared with students who were not interested in surgery. Further, students were more likely to identify a mentor if they were interested in surgery, and if they applied for a residency, had lower levels of burnout. The results of the Kassam et al. study [6] illustrate the effects of exposure through skills workshops and the importance of establishing an interest in surgery prior to a clinical rotation, especially in the context of studies like the one from Brundage et al. [2], who reported that 59% of students made their career decision before the clinical year [2, 6]. The majority of participants at the Philadelphia Surgery Conference were first- or second year students who gained important preclinical exposure to the surgical fields.

Cultivating clinical surgical skills

The intention of the Philadelphia Surgery Conference was not only to broaden participants' interest in surgery, but also to increase their sense of confidence in technical skills. One major focus of the event was to actively engage each attendee, with careful consideration of preparation for surgical rotations and comfort level in a surgical setting. Surgical skills workshops, whether led by student-run surgical interest groups [1], residents [9], or faculty [10], increase students' confidence and perceived competence in suturing and interest in surgery. These results are also generalizable to many surgical subspecialties. Nitschmann et al. [11] implemented a gynecologic simulation training for medical students during their third-year core clerkship in obstetrics and gynecology and found that students reported improved confidence in performing the procedures and increased interest in pursuing a surgical field posttraining [11]. Encouraging data have also been revealed in previous studies in vascular [12] and cardiothoracic surgery [13]. Our results reiterate the value of surgical skills workshops, as our data showed a 52.6% increase from baseline in confidence in personal surgical skills ($p<0.001$) and a 34.6% increase in understanding of the various surgical subspecialties after the conference ($p<0.001$).

Facilitating interactions with resident and attending physicians

The event allowed students the unique opportunity to interact with resident and attending physicians from many surgical subspecialties. Size restrictions in each workshop served to establish a more personal, low-stress, academic setting for interaction between students and surgeon facilitators, encouraging students to ask questions and receive feedback. In a study done by Meyer and Weiner [14], subsequently described by Bland [3], lack of interest in surgery in second year medical students stemmed from a lack of contact with surgical faculty. Further studies have demonstrated that exposure to role models in specific fields of medicine strongly correlate with the student's choice of specialty later in their career [15], with two-thirds of students in one study (n=56; 66%) choosing the same specialty as their mentor [16].

In addition to surgeons, surgical residents can play an important role as mentors and role models, as they usually have more interactions with medical students. Schmidt [17] summarized previous work by Musunuru et al. [18], who found that students exposed to surgical residents who are effective educators and mentors were more likely to pursue surgery than those who were not. Students value mentors with clinical skills, personality, and teaching ability [15]. Mentors set examples for their mentees; mentor-mentee interactions are the second most important factor in predicting excellence in the field [16]. Prior to the conference, more than half of students (168; 51.2%) "highly" valued hands-on clinical practice and face-to-face interactions with resident and attending physicians (168; 60.7%), and nearly three-quarters of students (168; 71.4%) "highly" valued the experiences in medical school when considering a potential future career in surgery. Our results further demonstrate the importance of interactions with resident and attending physicians, as there was a 7.3% increase from baseline in the value of hands-on clinical practice ($p=0.014$), a 9.3% increase in the value of face-to-face interactions ($p=0.002$), and a 4.4% increase in the value of experiences in medical school ($p=0.470$).

Assistance in establishing mentor relationships is crucial for medical students. From the relationships formed throughout the conference, students may have a more established outlet to seek out research opportunities, as performing research before or during medical school was

strongly correlated with having a mentor [19], as well as an increased likelihood of matching into a surgical specialty and completing a surgical residency [20, 21].

Collaborating with medical counterparts

The conference intentionally invited osteopathic and allopathic medical students as well as physician assistant students from a wide range of institutions to put into early practice a collaborative effort in building competent, well-rounded surgical "team players." With the evolution of medical care delivery, there has been increasing emphasis on the importance of interprofessional education (IPE), communication, and cooperation between healthcare providers to ensure patient safety [22]. Baker [22] summarized previous work by Alonso et al. [23], who found that the TeamSTEPPS curriculum released as the national standard in health care team training in 2006 has resulted in a reduction of retained foreign objects, reduction in errors, and improvement in properly timed administration of prophylactic measures in the operating room. Exposure and practice of effective communication skills and teamwork strategies during medical education can help develop knowledge, skills, and attitudes that facilitate effective interprofessional team behaviors and competence early on in students' careers. Our results echo past literature, as 75.3% of our respondents "highly" valued collaboration with students from other schools and programs. In a study done by Reeves et al. [24], subsequently described by Baker [22], IPE positively changed learners' attitudes towards one another's professions. After the conference, nearly half of participants (89; 42.7%) reported a change in their perception of osteopathic surgeons.

Limitations

Although our data showed promising results, there were some limitations to the study. First, the students in attendance likely had an initial interest in surgery prior to the event, as registration was voluntary, which may have introduced bias and may not accurately represent all students in all clinical training programs. There also may have been attrition bias, as 96.0% of participants completed the preconference survey, but only 50.9% completed the postconference survey. Those who stayed to complete the postconference survey may have had a more positive attitude toward the conference, positively skewing the results. Additionally, self-reported data contain potential sources of bias, such as selective memory and exaggeration. Last, most participants were first- or second-year medical students, with a large majority (73.1% of attendants) being students from PCOM Philadelphia campus, which may affect external generalization.

Conclusions

Based on survey results, the 2019 Philadelphia Surgery Conference was a successful and valuable event for medical and physician assistant students. The conference provided exposure to a variety of surgical disciplines and clinical simulations, as well as a forum to interact with resident and attending physicians and other professional health care students. Following the event, a few students who were not previously interested in a surgical field gained interest, some changed their surgical interest, and many increased their confidence in their surgical abilities and their understanding of the surgical disciplines. The value students place on hands-on workshop-based experiences, face-to-face interactions with resident and attending physicians, and medical school experiences increased as having an influence on their future career path. These promising results provide argument for further incorporation of these skill-based workshops into medical education. Future studies to expand on these results will explore the conference's longitudinal effects on students' specialty choice, technical and collaborative skills, and career accomplishments.

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