

Early exposure to hands-on surgical training encourages urological interest in undergraduate medical students

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Abstract

Background: Urological education is as important as surgical training for undergraduates. However, those in undergraduate medical schools have less exposure to surgery and urology as their curriculum focuses more on clinical skills, particularly community-based healthcare for a super-aging society. This study aimed to evaluate whether urologic hands-on training could encourage surgical and urological interest in medical undergraduate students.

Methods: A one-day elective program in urologic surgery at the University of Tsukuba, particularly in robotic, laparoscopic, and endoscopic surgeries, was offered to 58 fourth-year medical students in 2018 and 2019, prior to their clinical clerkship. The average age of participants was 22 (range: 21–25) years. We assessed scores (1–5 Likert-type items) in training activity, interest in surgery, and interest in urology before and after the course.

Results: Before attending the program, average scores in interest in urology were 3.53 in 2018 and 3.15 in 2019. After training, the total likely scores of this program in 2018 and 2019 were 4.59 and 4.76, respectively. The likely scores in surgery increased after the program; however, this was not significantly different to that prior to the program. However, the average interest scores in urology were significantly increased to 3.91 ± 0.63 ($p < 0.05$) and 3.88 ± 0.58 ($p < 0.01$) in 2018 and 2019, respectively, indicating a motivation to pursue surgery and urology following clinical clerkship, 1 year after training.

Conclusions: Urological hands-on training facilitated interest in urology in medical students prior to their clinical clerkship. Early experience in actual urological procedures could encourage medical students to consider specializing in urology and pursue a career as a urological specialist.

Background

Medical school provides an opportunity to not only acquire the knowledge and skills but also experience in various specialties. Medical students in lower years of study, study and learn with the help of classroom lectures and other recently adopted clinically-oriented teaching methods¹. After gaining basic medical knowledge, they learn skills through a rotating clinical clerkship over a period of 6 years after graduating from high school in Japan². In addition to subject knowledge, medical students must learn the required attitude and skills that make them qualified to meet the needs of citizens³. In Japan, upcoming medical doctors should have clinical skills, especially in community-based health care for the super-aging society⁴. Thus, medical schools are modifying their curriculum to consider these societal needs. Thus, medical students obtain less experience in surgical subjects than in other essential medical specialties such as internal medicine, psychology, and primary healthcare⁵. To bridge this increasing gap in knowledge, several surgical departments have been trying to teach surgery more efficiently in an educational program (such as simulation-based learning) during clerkship.

Simulation-based learning is broadly used in medical schools globally. Simulation is very useful for beginners to learn invasive procedures, including the physical examination, puncture procedures, and emergency treatment⁶. To achieve better outcomes with simulation-based education, the following factors need to be considered: range of difficulty, repetitive practice, distributed practice, cognitive interactivity, multiple learning strategies, individualized learning, mastery learning, feedback, length of training, and clinical variation⁷. For expert training, more novel challenges are recommended. However, this adds to the financial cost and burden of faculties as simulation equipment is expensive and requires that instructors put in extra work. Nevertheless, simulation-based education is effective in imparting basic science and clinical knowledge and improving procedural skills, teamwork, and communication skills in undergraduate and graduate medical students⁸.

Choosing a specialty is one of the most important decisions for medical students⁹. In Japan, postgraduates rotate through several specialties within two years as junior residents before starting their training in their selected specialty². Medical students and junior residents choose their specialty based on a variety of factors, including medical lifestyle, societal orientation, hospital orientation, scope of practice, and the impact of role models¹⁰. Compared to any other specialty, urology is less popular among medical students due to the misconception that urologists are generally male organ specialists¹¹. A urologist deals with the entire genitourinary system of men and women. Moreover, the need for female urologists has increased over the past 10 years¹². Medical students' misunderstanding of urology will remain uncorrected unless they are exposed to the correct clinical circumstances. Students are more likely to be influenced to pursue surgical careers if they are offered early exposure to positive role models and career and academic opportunities¹³. Thus, early involvement of medical students may provide ideal opportunities or mentored externships for recruitment, not only in urology but also in other departments.

The school of medicine at the University of Tsukuba has given an "advanced course" to fourth-year medical students prior to starting their clinical clerkship. This short course consists of intensive lectures based on the concept of exposing pre-clinical clerkship students to recent, focused, and advanced medical issues. Several professors offer lectures on various disciplines such as basic science, medical statistics, internal medicine, psychology, surgery, anaesthesia, social medicine, and space medicine. Each student can select several courses in their fields of interest over one week. Our urology department has given hands-on seminars on endoscopic, laparoscopic, and robotic surgeries since 2012. Students who had attended this course were motivated to learn about surgery and were more interested in urology.

We hypothesized that specific factors could contribute to urological and surgical experience and that a positive experience would be associated with students' interest in a career in not only surgery but also in urology. This study evaluated whether this urology course, designed to provide the required exposure to medical students, could cultivate an interest in surgery and urology among pre-clinical clerkship medical students.

Methods

Course design

A one-day elective course focused on hands-on training in urologic surgery, particularly robotic, laparoscopic, and endoscopic surgeries, was offered to fourth-year medical students of the University of Tsukuba in 2018 and 2019. Participants were separated into three groups. Subsequently, each group rotated through endoscopic procedures, laparoscopic suturing, and robotic surgery, respectively, over 2 hours (Fig. 1). The grouped students were further separated into four subgroups rotating through endoscopic workshops lasting for 30 minutes each, including cystoscopy, transurethral resection, laser prostatectomy, and transurethral lithotripsy (Fig. 2).

In the robotic surgery course, students used the DaVinci skills simulator of preinstalled tasks including “Endo Wrist Manipulation”, “Energy and Dissection”, and “Needle Control and Driving”. In the laparoscopic course, the students were trained in suturing skills using string with a needle in a dry box. Meanwhile, the students in the endoscopic course were divided into 4 groups: transurethral resection (TUR), photo-selective vaporization of the prostate (PVP), cystoscopy, and transurethral lithotripsy (TUL). During the TUR session, the students cut into a konjac plate (a jelly-like food made from the starch of the konjac potato) under a saline pool using the TUR system. During the PVP session, the laser vaporization procedure was demonstrated to students using a PVP simulator. During the cystoscopy session, students performed the cystoscopy procedure using a flexible cystoscope on a flask, which resembled the urinary bladder. During the TUL session, students used a flexible ureteroscope and basket forceps to remove simulated renal stones out of a urinary tract model.

Evaluation

Before the start of training, the participating students were asked to provide their demographic information in a pre-course survey. Moreover, they provided a self-assessment (1–5 Likert-type items) on their interests. They checked the “5” score when they were very interested, while a “1” was scored when they were not interested at all. After the training, the participating students and faculty members were made to answer a post-course survey in which they were able to provide a free description to the questions. To evaluate the long-term effect of the course, we used a web questionnaire on participating students. Evaluation of the participating students was performed 3 months after having taken the course in 2018. Conversely, the evaluation done in 2019 was performed after 1 year. The questionnaire was the same as the provided self-assessment (1–5 Likert-type items) and free description surveys.

Assessment

Data for these evaluations were collected from all students enrolled in the course who completed the pre- and post-course surveys. We analysed the mean difference in the interest score in surgery and urology before and after the program using paired t-tests in 2018 and 2019. All data analyses were performed using JMP14 and Microsoft Excel®. Descriptive statistics, chi-square test, or Fisher's exact test were used, as appropriate. We also analysed the answers obtained from the free description section of the questionnaire.

Results

Two-hundred and twenty-two medical students have selected to enrol in our course since 2012. Of these, 32 and 26 students took part in this course in 2018 and 2019, respectively (Table 1). The average age of participants was 22.2 (range: 21–24) years and 22 (range: 21–25) years in 2018 and 2019, respectively, among approximately 140 medical school fourth-year students. Overall, 34.4% and 38.5% of participants were female, respectively. Eleven urology faculty members including two female urologists and several staff members from the medical equipment company helped teach the workshops.

Table 1
Background characteristics of participants

Fiscal year		2018	2019	P-value		
No. of students		32	26			
Age	Median	22	22	n.s.		
	Range	21–24	21–25			
Sex	Male	21	65.6	16	61.5	n.s.
	Female	11	34.4	10	38.5	
Curiosity						
	Internal medicine	20	62.5	15	57.7	n.s.
	Surgery	22	68.8	15	57.7	n.s.
	Urology	14	43.8	5	19.2	0.044
Pre-course likely score						
Surgery	Average	4.12	4.00	n.s.		
	SD	0.148	0.111			
Urology	Average	3.53	3.15	0.06		
	SD	0.149	0.613			
n.s: not significant, SD, standard deviation						

Before attending the course in 2018, the average interest scores in surgery and urology were 4.12 and 3.53, respectively. Those in 2019 were 4.00 and 3.15, respectively. Attending students were already interested in surgery but not in urology.

After training, robotic surgery was the most interesting to participants in both periods. Regarding laparoscopic suturing, single port surgery tended to have more of a “less likely” score than the 3-dimensional and 2-dimensional classical laparoscopic procedures. Endoscopic procedures such as TUR,

PVP simulation, cystoscopy, and TUL were also attractive to medical students. The comprehensive evaluation scores of this course in 2018 and 2019 were 4.59 and 4.76, respectively (Fig. 3)

Table 2 shows the difference in likely scores before and after the course. After attending the course, the likely scores in surgery were higher, but this difference was not significantly different to that obtained prior to the course in both years. Interestingly, those of urology were significantly increased compared to those of the pre-course. Particularly, the number of students who selected a score of 5 increased, and the number of students who selected a score of 2 decreased (Fig. 4). Free description questionnaire results showed that medical students became more interested in urology and surgery and felt motivated for their clinical clerkship. Faculty members found the teaching workload and burden of costs too high; thus, they placed their clinical practice ahead of teaching the course. However, they felt that the course was very important for medical students in addition to clinical practice.

Table 2
Likely scores of interest for surgery and urology before and after the course

		Surgery		Urology	
		2018	2019	2018	2019
Average	Before	4.13	4.00	3.53	3.15
	After	4.34	4.27	3.91	3.88
Effect size		0.18	0.35	0.35	0.72
Mean difference		0.22	0.27	0.38	0.73
Standard deviation		0.21	0.14	0.18	0.14
Upper 95%		0.65	0.56	0.74	1.02
Lower 95%		-0.21	-0.02	0.01	0.44
P-value		0.30	0.07	0.04	0.00

To evaluate the long-term effect of this course, we performed a post-course web questionnaire, with 13 (40.6%) students in 2018 and 17 (65.4%) in 2019 completing the questionnaire. Table 3 shows the results of the long-term evaluation. Regarding memory, "Remember the course" maintained very high scores of 4.53 ± 0.50 3 months after the course and 4.62 ± 0.49 1 year after the course. Regarding the effect on learning during clerkship, this course played a significant role on the effect of learning both surgery and urology. However, the scores obtained for interest in surgery and urology gradually decreased over time (Fig. 5.). The average likely scores dropped to below 4 in surgery and below 3 in urology.

Table 3
Long-term effect of this course

		2018		2019	
		Ave	SD	Ave	SD
Remembering	Whole course	4.62	0.49	4.53	0.50
	Robotic surgery	4.31	0.82	4.12	0.68
	Single port surgery	3.54	1.08	3.47	0.98
	3-dimensional laparoscopy	3.62	0.92	4.06	0.64
	Laparoscopic surgery	4.54	0.63	4.12	0.90
	TUR	3.85	0.86	2.65	0.84
	PVP	3.85	0.95	3.24	1.06
	Cystoscopy	3.69	0.99	2.82	0.98
	TUL	3.77	0.89	3.00	0.97
	Interested in	Surgery	4.54	0.63	4.24
Urology		3.54	1.01	3.24	0.55
Affect the learning at clerkship	Surgery	4.15	0.77	4.35	0.76
	Urology	4.23	0.70	3.88	0.68
Career selection	Surgery	3.92	0.92	3.76	1.00
	Urology	2.85	1.03	2.47	0.61
SD: standard deviation, ave: average, PVP: photo-selective vaporization of the prostate, TUL: transurethral lithotripsy, TUR: transurethral resection					

Discussion

According to this study, early exposure to urological hands-on training in pre-clinical clerkship students resulted in an increasing interest, especially in urology. Surgical training courses were generally conducted during clinical clerkship or postgraduate periods¹⁴. The most novel aspect of this study was conducting a hands-on course that focused on urological training in medical students prior to clinical clerkship.

Early exposure is an effective method for educating medical students in not only basic science but also clinical clerkship^{15,16}. This study showed that hands-on training in urologic procedures impacted on pre-clinical clerkship medical students as it increased their interest in urology. However, this course did not

increase the interest in surgery among students who already had an interest in surgery prior to the course. Thus, it was of limited value to those who showed an interest prior to the course. In contrast, this course made a good impression on students with regards to urology. Generally, there were more students interested in surgery than in urology at the beginning of the course. Moreover, what urologists do is relatively unknown to the public compared to what is done in surgery, internal medicine, paediatrics, and other specialties. The lesser-known specialities may be able to promote their specialty and the roles they play to medical students in their earlier years of training as well as the public. As medical students are rarely provided with experience in performing not only surgical procedures but also independent simulated surgeries prior to undergoing their clinical clerkship, this course could have a great impact on medical students prior to their clinical clerkship.

As a systematic review and meta-analysis showed that technology-enhanced simulation was more effective than instructional methods, actual experience could be beneficial for learners¹⁷. In this course, students could perform surgical procedures and use simulators for a certain amount of time under the supervision of several faculty members. Regarding endourologic skills, early feedback can be beneficial when learning through novel simulation training¹⁸. Thus, these experiences may encourage students to learn surgery and urology further following their clinical clerkship. However, numerous experiences may influence their choices because medical students must rotate through several subjects for a long period of time during their clerkship. Recently, motivation was found to be one of the most important factors for continuing learning in the field of medical education¹⁹. To maintain and improve the effect of the course, surgeons and urologists should continue offering students the opportunity to obtain surgical experience and the opportunities provided to them during their surgery and urology rotations should be performed using technical and educational approaches such as the motivational dynamic model¹⁹.

Early clinical experience has a degree of influence on the selection of a particular career by undergraduate students⁷. In Japan, medical students usually undergo a 2-year primary resident course followed by a 4-year specialized medical course to pursue their career path²⁰. The career chosen by medical students depends on their experiences since birth and their own prerogatives. Particularly, parental career expectations may also have an impact on their career choice²¹. However, for medical undergraduates, exposure to specialties and the timing of this exposure are crucial to career choice; this is true for any specialty²². Medical students should rotate through several departments during their clinical clerkship, although not through all departments. Most medical school curriculums tend to focus on good clinical practitioners who are trained to care for a super-aging society; thus, the time spent rotating through surgical departments is likely to decrease. This limits the exposure of students, particularly those with an interest in surgery, to non-essential subjects. Several medical experts have been trying to recruit young doctors and medical students in Japan as junior residents are able to select their specialty of choice freely. As there are several reports showing that short courses and surgical simulations could influence their choice in career specialty, early exposure to surgical subspecialties could influence students to pursue a career in these fields²³⁻²⁶. In contrast, several surgical departments showed that early surgical exposure increased their understanding and interests; although, it did not affect their career choice²⁷.

Regarding urology, only a limited number of medical schools require a formal educational rotation in urological surgery; thus, medical students perceive their knowledge of urology as poor even when medical students are aware of urology as a specialty²⁸. In contrast, clinical performance during a rotation at their school is the most important factor taken into account when choosing future urology residents²⁹. Regarding timing, a report showed that third-year medical students were more likely to consider urology than final-year students due to multifactorial reasons³⁰. Extrinsic and intrinsic motivation was correlated with several factors such as being female, personal choice, and positive attribute of determination³¹. Accordingly, this early exposure course, provided during fourth year, could be an effective initiation to a urological career for medical students prior to clinical clerkship.

This study has several limitations. First, the number of students was small because this course was conducted by a single urology department at a medical school. Second, although an increase in scores for surgery and urology were found, we only evaluated the change in likely scores before and after the course. However, we did not compare this to a control group. Third, as students had not yet graduated and selected their specialty, the true outcome could not be evaluated, Further long-term studies are required to determine whether the course results in graduates selecting surgical or urological specialties. However, this study found that early exposure to hands-on training in urology increased students interest in urology. This course may be used by other departments to encourage students to learn or take up their specific specializations.

Conclusions

Urological hands-on training encouraged interest in urology among medical students prior to their clinical clerkship. Early experience in actual surgical techniques could motivate students to learn about surgical specialties during their clinical clerkship as well as encouraging them to pursue a career in a surgical specialty.

Abbreviations

PVP, photo-selective vaporization of the prostate

TUL, transurethral lithotripsy

TUR, transurethral resection

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee at Medical school, University of Tsukuba (approval number 19-1394). The study participants provided written informed consent.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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No funding was received for this study.

Authors' contributions

TKi analyzed and interpreted this study data and write most of the manuscript. TKi, KK, AI, SK, TKo, and HN contributed this course as faculty members. JH was contributed important and unique insight to the article. All authors read and approved the final manuscript.

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Figures

Start	1				2				3					
	A	B	C	D	A	B	C	D	A	B	C	D		
900	Guidance & Questionnaire													
930	Robotic surgery	Single port dry box 3D laparoscopy			TUL	TUR	Cystoscope	PVP	Laparoscopic surgery					
1000					PVP	TUL	TUR	Cystoscope						
1030	Single port dry box 3D laparoscopy			Robotic surgery	Cystoscope	PVP	TUL	TUR						
1100					TUR	Cystoscope	PVP	TUL						
1130	Rest & transfer													
1200	Laparoscopic surgery				Robotic surgery	Single port dry box 3D laparoscopy			TUL	TUR	Cystoscope	PVP		
1230									PVP	TUL	TUR	Cystoscope		
1300					Single port dry box 3D laparoscopy			Robotic surgery	Cystoscope	PVP	TUL	TUR		
1330									TUR	Cystoscope	PVP	TUL		
1400	Rest & transfer													
1430	TUL	TUR	Cystoscope	PVP	Laparoscopic surgery				Robotic surgery	Single port dry box 3D laparoscopy				
1500	PVP	TUL	TUR	Cystoscope										
1530	Cystoscope	PVP	TUL	TUR					Single port dry box 3D laparoscopy			Robotic surgery		
1600	TUR	Cystoscope	PVP	TUL										
1630	Transfer & Questionnaire													
17:30	Wrap up & Closing remark													

Figure 1

Rotation schedule of medical students Students are divided into small groups of 2 or 3 students each, and they rotated through each procedure.



Figure 2

The schema of the arrangement of the training room and pictures of each procedure Small groups move around the room in a circle, spending 30 minutes at each station.

Likely score of each procedure

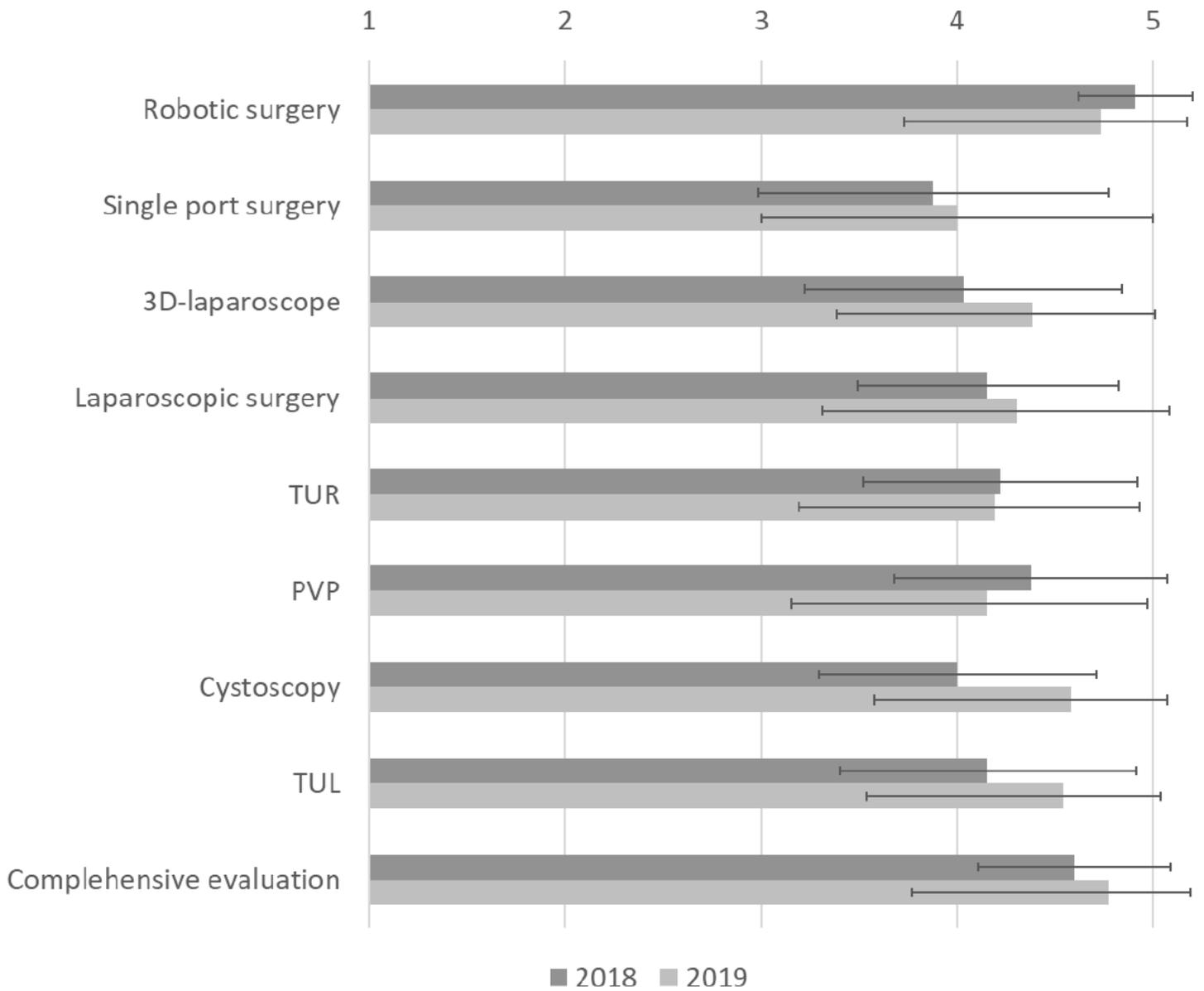
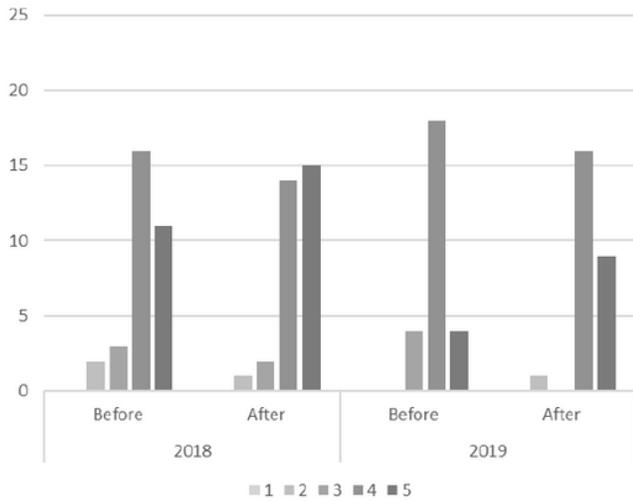


Figure 3

Likely scores of interest for surgery and urology before and after the course

Interest in Surgery



Interest in Urology

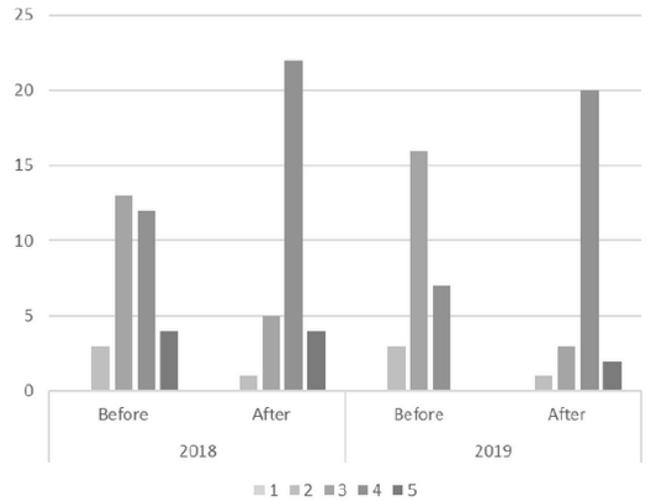
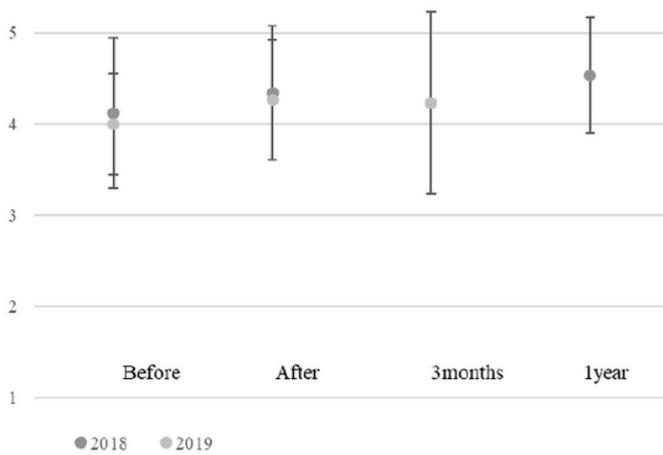


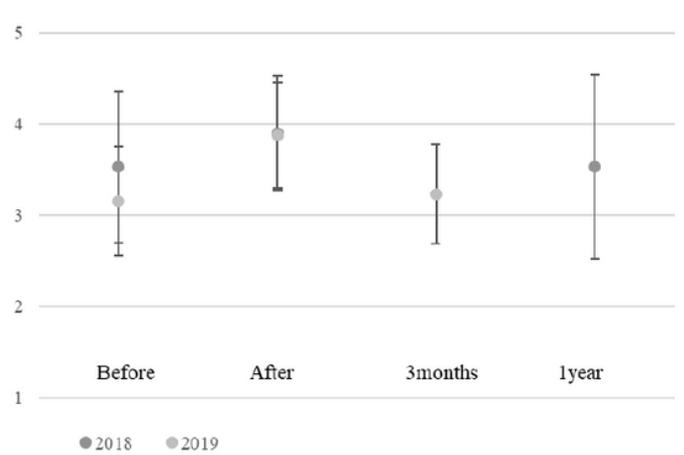
Figure 4

Likely scores in each course after the training

Interest in Surgery



Interest in Urology



Interest of Surgery	2018		2019		
	Ave	SD	Ave	SD	
Before	4.13	0.82	Before	4.00	0.55
After	4.34	0.73	After	4.27	0.65
1year	4.54	0.63	3months	4.24	1.00

Interest of Urology	2018		2019		
	Ave	SD	Ave	SD	
Before	3.53	0.83	Before	3.15	0.60
After	3.91	0.63	After	3.88	0.58
1year	3.54	1.01	3months	3.24	0.55

Figure 5

Time course of likely scores of interests for surgery and urology