

MEDICAL STUDENTS' PERCEPTION OF ROBOTIC SURGERY

Hillary Liu Sun

USA

ABSTRACT

As robotic surgery advances internationally, standardized training remains lacking. It's unclear what medical students know and if they're prepared for it. This study aimed to assess medical students' knowledge and attitudes toward robotic surgery. A cross-sectional study was conducted at the University of Illinois at Chicago in early 2024. Before a lecture by Dr. Gangemi, students completed a 24-question form. Of the 63 students that participated, most were first-year students. 66.67% of the students identified as tech-savvy and 60.32% were interested in surgical careers. While 55.56% reported prior knowledge of robotic surgery, only 36.51% knew their institution offered related training. Support for robotic surgery was strong: 80.95% favored adoption and 93.66% supported integration into medical curricula. However, 25.4% expressed concern about diminished manual skills. Overall, medical students demonstrated limited knowledge but positive attitudes, highlighting the need for formal implementation to ensure proper education.

KEYWORDS

Robotic Surgery, Perceptions, Attitudes, Medical Students, Curriculum Development

1. INTRODUCTION

Robotic surgery is a minimally invasive surgery, in which the surgeon controls the robot's arm movements. Robotic surgery continues to advance quickly and be introduced to increasing numbers of different surgical practices. Robotic surgery has been in development since 50 years ago and became in use in the late 1980s. The most widely used robotic system is the Da Vinci system, with over 11 million robotic surgeries having been performed as of 2023 [1]. Evidence shows the benefits of robotic surgery are better visualization, greater precision, greater range of motion, shorter recovery times because of less blood loss, and overall less mental exhaustion on the surgeon [2, 3].

As robotic surgery continues to advance and spread rapidly to all areas of surgical specialties, it's important that medical students, especially surgical trainees, are educated about it [4]. This relatively new surgical approach is a novel technology that is not coupled with a formal education during medical school training [5]. Much of the acquired knowledge by prospective doctors and surgeons, who are currently in medical school, are gathered through the internet and media and thus are not subject to formal control of their quality [6]. It's key that current medical students, the next generation of robotic surgeons, are able to receive proper training and clinical experiences about robotic surgery.

The aim of this study is to learn and analyze the current knowledge medical students have about robotic surgery, and the attitudes they might have towards robotic surgery, to see if they should be

offered curricular learning opportunities on robotic surgery. We cannot predict the attitudes medical students will have towards robotic surgery.

2. METHODS

A cross-sectional study was performed at the University of Illinois at Chicago, in the first half of 2024. Our research approach was qualitative, and all of the participants were selected using a non-probability convenient sampling method, in which the students who saw the poster that was spread and came to the lecture, participated in the survey. The poster promoted a lecture, hosted by Dr. Antonio Gangemi about robotic surgery. Before the lecture started, everyone present was asked to fill out the 24 question google form. The inclusion criteria included any medical students studying at the University of Illinois at Chicago of any nationality, gender, and academic year. Students were excluded from the study if they had incomplete data of any kind. The questionnaire that was used was split into 3 sections: current knowledge (10 questions), attitudes towards robotic surgery (8 questions), and demographic (6 questions). This questionnaire was first developed by other researchers and was modified to fit our study purposes [6].

2.1. Data Analysis

Survey responses were collected through a Google Form and exported into Microsoft Excel for analysis. Descriptive statistics, including frequencies and percentages, were calculated to summarize demographic information, current knowledge, and opinions toward robotic surgery. In addition, responses were further cross tabulated by academic year and attitudes across subgroups. This allowed for the identification of specific patterns, such as whether early-year and later-year students differed in their knowledge of robotic surgery or attitudes. Results are presented in tables to highlight the differences across student subgroups and for clarity.

3. RESULTS

During the beginning of 2024, a total of 63 medical students from the University of Illinois at Chicago responded to the google form. At the University, 36 students identified as female (57.14%) and 25 students identified as male (39.68%). The median age was 25 years, ranging from 20 to 39 years, and the majority of students were in their 1st year, 28 students (44.44%), and 23 students in their 2nd year (36.51%). An overwhelming majority of 56 medical students (88.89%) were from North America. More than half, 60.32%, showed a prospective interest in a surgical career and two-thirds of the respondents, 42 students (66.67%), considered themselves tech-savvy.

3.1. Participant Demographics

The second set of questions inquired about medical students' current knowledge about robotic surgery. A slight majority, 35 students (55.56%), of the medical students had background knowledge in robotic surgery, and around one-fourth expressed interest in learning about it. Although 28.57% of students heard about robotic surgery through a class offered in a medical school curriculum, the majority of respondents, 63.49%, were not aware of robotic surgery classes offered at UIC. Also, 84.31% of first and second year students learned about robotic surgery from other places, such as the internet, workshop, TV or Radio, etc. Although 100% of the students who had previous knowledge about robotic surgery defined it correctly, only 8 students (22.86%) were able to properly determine all the benefits of robotic surgery.

Table 1. What is your gender?

What is your gender?					
	Male	Female	Other	Prefer not to answer	Total
Year 1	11 (39.29%)	16 (57.14%)	1 (3.57%)	0 (0%)	28
Year 2	9 (39.13%)	14 (60.87%)	0 (0%)	0 (0%)	23
Year 3	4 (50%)	4 (50%)	0 (0%)	0 (0%)	8
Year 4	1 (25%)	2 (50%)	1 (25%)	0 (0%)	4
Total	25 (39.68%)	36 (57.14%)	2 (3.17%)	0 (0%)	63

Table 2. Where are you from?

Where are you from?									
	North America	South America	Italy	European Union country (other than Italy)	European country other than European Union	Asia	Africa	Australia	Total
Year 1	23 (82.14%)	2 (7.14%)	0 (0%)	0 (0%)	0 (0%)	2 (7.14%)	1 (3.57%)	0 (0%)	28
Year 2	23 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	23
Year 3	7 (87.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (12.5%)	0 (0%)	0 (0%)	8
Year 4	3 (75%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)	0 (0%)	0 (0%)	4
Total	56 (88.89%)	2 (3.17%)	0 (0%)	0 (0%)	0 (0%)	4 (6.35%)	1 (1.59%)	0 (0%)	63

Table 3. Do you consider yourself a tech-savvy person?

Do you consider yourself a tech-savvy person?			
	Yes	No	Total
Year 1	20 (71.43%)	8 (28.57%)	28
Year 2	15 (65.22%)	8 (34.78%)	23
Year 3	5 (62.5%)	3 (37.5%)	8
Year 4	2 (50%)	2 (50%)	4
Total	42 (66.67%)	21 (33.33%)	63

Table 4. Which academic year are you currently attending?

Which academic year are you currently attending?					
	1st	2nd	3rd	4th	Total
Year 1	28 (100%)	0 (0%)	0 (0%)	0 (0%)	28
Year 2	0 (0%)	23 (100%)	0 (0%)	0 (0%)	23
Year 3	0 (0%)	0 (0%)	8 (100%)	0 (0%)	8
Year 4	0 (0%)	0 (0%)	0 (0%)	4 (100%)	4
Total	28 (44.44%)	23 (36.51%)	8 (12.70%)	4 (6.35%)	63

Table 5. Do you have a prospective interest in a surgical career?

Do you have a prospective interest in a surgical career?				
	Yes	No	I am not sure	Total
Year 1	18 (64.29%)	6 (21.43%)	4 (14.29%)	28
Year 2	12 (52.17%)	4 (17.39%)	7 (30.43%)	23
Year 3	6 (75%)	2 (25%)	0 (0%)	8
Year 4	2 (50%)	2 (50%)	0 (0%)	4
Total	38 (60.32%)	14 (22.22%)	11 (17.46%)	63

3.2. Current Knowledge About Robotic Surgery

The second set of questions inquired about medical students' current knowledge about robotic surgery. A slight majority, 35 students (55.56%), of the medical students had background knowledge in robotic surgery, and around one-fourth expressed interest in learning about it. Although 28.57% of students heard about robotic surgery through a class offered in a medical school curriculum, the majority of respondents, 63.49%, were not aware of robotic surgery classes offered at UIC. Also, 84.31% of first and second year students learned about robotic surgery from other places, such as the internet, workshop, TV or Radio, etc. Although 100% of the students who had previous knowledge about robotic surgery defined it correctly, only 8 students (22.86%) were able to properly determine all the benefits of robotic surgery.

Table 6. Do you have any background knowledge of robotic surgery?

Do you have any background knowledge of robotic surgery?				
	Yes	No	No, but I would like to know more about it	Total
Year 1	14 (50%)	5 (17.86%)	9 (32.14%)	28
Year 2	11 (47.83%)	7 (30.43%)	5 (21.74%)	23
Year 3	6 (75%)	0 (0%)	2 (25%)	8
Year 4	4 (100%)	0 (0%)	0 (0%)	4
Total	35 (55.56%)	12 (19.05%)	16 (25.40%)	63

Table 7. Where did you hear about robotic surgery?

Where did you hear about robotic surgery?							
	Internet	TV or Radio	Workshop	Class offered in the setting of medical school curriculum	Friends outside of medical school	Nowhere	Total
Year 1	10 (35.71%)	3 (13.04%)	6 (21.43%)	5 (17.86%)	2 (7.14%)	2 (7.14%)	28
Year 2	3 (13.04%)	2 (8.70%)	9 (39.13%)	3 (13.04%)	3 (13.04%)	3 (13.04%)	23
Year 3	0 (0%)	1 (12.5%)	1 (12.5%)	6 (75%)	0 (0%)	0 (0%)	8
Year 4	0 (0%)	0 (0%)	0 (0%)	4 (100%)	0 (0%)	0 (0%)	4
Total	13 (20.63%)	6 (9.52%)	16 (25.40%)	18 (28.57%)	5 (7.94%)	5 (7.94%)	63

Table 8. Do you know if the University of Illinois College of Medicine offers robotic surgery training and/or courses and/or classes?

Do you know if the University of Illinois College of Medicine offers robotic surgery training and/or courses and/or classes?			
	Yes	No	Total
Year 1	12 (42.86%)	16 (57.14%)	28
Year 2	6 (26.01%)	17 (73.91%)	23
Year 3	2 (25%)	6 (75%)	8
Year 4	3 (75%)	1 (25%)	4
Total	23 (36.51%)	40 (63.49%)	63

Table 9. How is robotic surgery done?

How is robotic surgery done?				
	A robot performs the surgery under supervision of a surgeon in the operating room	A pre-programmed robot performs the surgery autonomously	A surgeon performs the surgery by maneuvering a surgical robot inside the operating room	Total
Year 1	1 (3.57%)	0 (0%)	27 (96.43%)	28
Year 2	1 (4.35%)	0 (0%)	22 (95.65%)	23
Year 3	1 (12.5%)	0 (0%)	7 (87.5%)	8
Year 4	0 (0%)	0 (0%)	4 (100%)	4
Total	3 (4.76%)	0 (0%)	60 (95.24%)	63

Table 10. Robotic surgery provides better ergonomics for the surgeon than the more traditional minimally invasive surgery (laparoscopy)

Robotic surgery provides better ergonomics for the surgeon than the more traditional minimally invasive surgery (laparoscopy)						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	1 (3.57%)	9 (32.14%)	14 (50%)	4 (14.29%)	28
Year 2	0 (0%)	0 (0%)	7 (30.43%)	11 (47.83%)	5 (21.74%)	23
Year 3	0 (0%)	0 (0%)	1 (12.5%)	5 (62.5%)	2 (25%)	8
Year 4	1 (25%)	0 (0%)	0 (0%)	1 (25%)	2 (50%)	4
Total	1 (1.59%)	1 (1.59%)	17 (26.98%)	31 (49.21%)	13 (20.63%)	63

Table 11. Robotic surgery provides higher quality vision than the more traditional minimally invasive surgery (laparoscopy)

Robotic surgery provides higher quality vision than the more traditional minimally invasive surgery (laparoscopy)						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	0 (0%)	7 (25%)	14 (50%)	7 (25%)	28
Year 2	0 (0%)	2 (8.70%)	8 (34.78%)	8 (34.78%)	5 (21.74%)	23
Year 3	0 (0%)	2 (25%)	1 (12.5%)	4 (50%)	1 (12.5%)	8
Year 4	0 (0%)	0 (0%)	1 (25%)	0 (0%)	3 (75%)	4
Total	0 (0%)	4 (6.35%)	17 (26.98%)	26 (41.27%)	16 (25.40%)	63

Table 12. Robotic surgery instruments are capable of greater freedom of movement than laparoscopic instruments

Robotic surgery instruments are capable of greater freedom of movement than laparoscopic instruments						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	2 (7.14%)	7 (25%)	14 (50%)	5 (17.86%)	28
Year 2	0 (0%)	1 (4.35%)	7 (30.43%)	10 (43.48%)	5 (21.74%)	23
Year 3	0 (0%)	1 (12.5%)	1 (12.5%)	3 (37.5%)	3 (37.5%)	8
Year 4	1 (25%)	0 (0%)	0 (0%)	2 (50%)	1 (25%)	4
Total	1 (1.59%)	4 (6.35%)	15 (23.81%)	29 (46.03%)	14 (22.22%)	63

Table 13. Robotic surgery is safer than the more traditional minimally invasive surgery (laparoscopy)

Robotic surgery is safer than the more traditional minimally invasive surgery (laparoscopy)						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	3 (10.71%)	15 (53.57%)	8 (28.57%)	2 (7.14%)	28
Year 2	0 (0%)	2 (8.70%)	12 (52.17%)	8 (34.78%)	1 (4.35%)	23
Year 3	0 (0%)	0 (0%)	6 (75%)	2 (25%)	0 (0%)	8
Year 4	1 (25%)	0 (0%)	0 (0%)	2 (50%)	1 (25%)	4
Total	1 (1.59%)	5 (7.94%)	33 (52.38%)	20 (31.75%)	4 (6.35%)	63

Table 14. Robotic surgery is more effective than the traditional minimally invasive surgery (laparoscopy)

Robotic surgery is more effective than the traditional minimally invasive surgery (laparoscopy)						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	3 (10.71%)	17 (60.71%)	8 (28.57%)	0 (0%)	28
Year 2	0 (0%)	1 (4.35%)	13 (56.52%)	8 (34.78%)	1 (4.35%)	23
Year 3	0 (0%)	1 (12.5%)	5 (62.5%)	2 (25%)	0 (0%)	8
Year 4	0 (0%)	0 (0%)	2 (50%)	2 (50%)	0 (0%)	4
Total	0 (0%)	5 (7.94%)	37 (58.73%)	20 (31.75%)	1 (1.59%)	63

Table 15. Robotic surgery has expanded the applications of minimally invasive surgery to more complex surgery

Robotic surgery has expanded the applications of minimally invasive surgery to move complex surgeries						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	0 (0%)	3 (10.71%)	19 (67.86%)	6 (21.43%)	28
Year 2	0 (0%)	1 (4.35%)	6 (26.09%)	10 (43.48%)	6 (26.09%)	23
Year 3	0 (0%)	0 (0%)	0 (0%)	7 (87.5%)	1 (12.5%)	8
Year 4	0 (0%)	1 (25%)	0 (0%)	1 (25%)	2 (50%)	4
Total	0 (0%)	2 (3.17%)	9 (14.29%)	37 (58.73%)	15 (23.81%)	63

3.3. Current Knowledge About Robotic Surgery

The final set of questions examined the medical students' opinions on the future perspectives of robotic surgery. 51 (80.95%) medical students said they personally did support the adoption of robotic surgery, 53 (84.13%) students saying that robotic surgery will improve the outcomes reported with traditional laparoscopic surgery. Around 64.29% of medical students agreed that patients treated at the University of Illinois College of Medicine affiliated hospitals and American patients in general will accept having their surgeries done with a robotic approach. There were not many concerns with the rise in surgical robots and its effects on the surgeon's job and professionalism. Although 25.4% of the students had a concern of surgeons' manual skills weakening because of the rising use of surgical robots, an overwhelming 59 students (93.66%)

believed that medical schools should offer curricular and/or extracurricular learning opportunities on robotic surgery.

Table 16. Do you personally support the adoption of robotic surgery?

Do you personally support the adoption of robotic surgery?				
	Yes	No	I am not sure	Total
Year 1	23 (82.14%)	0 (0%)	5 (17.86%)	28
Year 2	18 (78.26%)	0 (0%)	5 (21.74%)	23
Year 3	7 (87.5%)	1 (12.5%)	0 (0%)	8
Year 4	3 (75%)	1 (25%)	0 (0%)	4
Total	51 (80.95%)	2 (3.17%)	10 (15.87%)	63

Table 17. Patients treated at the University of Illinois College of Medicine affiliated hospitals will accept having their surgeries done with a robotic approach

Patients treated at the University of Illinois College of Medicine affiliated hospitals will accept having their surgeries done with a robotic approach						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	0 (0%)	7 (25%)	19 (67.86%)	2 (7.14%)	28
Year 2	0 (0%)	4 (17.39%)	7 (20.43%)	7 (30.43%)	5 (21.74%)	23
Year 3	0 (0%)	1 (12.5%)	0 (0%)	6 (75%)	1 (12.5%)	8
Year 4	0 (0%)	0 (0%)	1 (25%)	3 (75%)	0 (0%)	4
Total	0 (0%)	5 (7.94%)	15 (23.81%)	35 (55.56%)	8 (12.70%)	63

Table 18. American patients in general will accept having their surgeries done with a robotic approach

American patients in general will accept having their surgeries done with a robotic approach						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	2 (7.14%)	8 (28.57%)	18 (64.29%)	0 (0%)	28
Year 2	0 (0%)	5 (21.74%)	7 (30.43%)	8 (34.78%)	3 (13.04%)	23
Year 3	0 (0%)	1 (12.5%)	1 (12.5%)	6 (75%)	0 (0%)	8
Year 4	0 (0%)	0 (0%)	1 (25%)	3 (75%)	0 (0%)	4
Total	0 (0%)	8 (12.70%)	17 (26.98%)	35 (55.56%)	3 (4.76%)	63

Table 19. Robotic surgery will eventually improve the outcomes reported with the more traditional laparoscopic surgery

Robotic surgery will eventually improve the outcomes reported with the more traditional laparoscopic surgery						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	0 (0%)	4 (14.29%)	20 (71.43%)	4 (14.29%)	28
Year 2	0 (0%)	1 (4.35%)	2 (8.7%)	13 (56.52%)	7 (30.43%)	23
Year 3	0 (0%)	0 (0%)	2 (25%)	6 (75%)	0 (0%)	8
Year 4	1 (25%)	0 (0%)	0 (0%)	2 (50%)	1 (25%)	4
Total	1 (1.59%)	1 (1.59%)	8 (12.70%)	41 (65.08%)	12 (19.05%)	63

Table 20. There is a real risk that with the further development of the technology, surgical robots will eventually replace surgeons in the future

There is a real risk that with the further development of the technology, surgical robots will eventually replace surgeons in the future						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	6 (21.43%)	13 (46.43%)	3 (10.71%)	3 (10.71%)	3 (10.71%)	28
Year 2	8 (34.78%)	9 (39.13%)	5 (21.74%)	1 (4.35%)	0 (0%)	23
Year 3	2 (25%)	5 (62.5%)	0 (0%)	0 (0%)	1 (12.5%)	8
Year 4	2 (50%)	0 (0%)	1 (25%)	0 (0%)	1 (25%)	4
Total	18 (28.57%)	27 (42.86%)	9 (14.29%)	4 (6.35%)	5 (7.94%)	63

Table 21. The rising use of surgical robots inside the operating room will weaken surgeons' manual skills

The rising use of surgical robots inside the operating room will weaken surgeons' manual skills						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	3 (10.71%)	11 (39.29%)	8 (28.57%)	6 (21.43%)	0 (0%)	28
Year 2	4 (17.39%)	6 (26.09%)	6 (26.09%)	7 (30.43%)	0 (0%)	23
Year 3	1 (12.5%)	3 (37.5%)	2 (25%)	1 (12.5%)	1 (12.5%)	8
Year 4	1 (25%)	2 (50%)	0 (0%)	1 (25%)	0 (0%)	4
Total	9 (14.29%)	22 (34.92%)	16 (25.40%)	15 (23.81%)	1 (1.59%)	63

Table 22. The rising use of robots will negatively impact surgeons' professionalism (e.g. skills, good judgement, and polite behavior)

The rising use of robots will negatively impact surgeons' professionalism (e.g. skills, good judgment, and polite behavior)						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	8 (28.57%)	14 (50%)	6 (21.43%)	0 (0%)	0 (0%)	28
Year 2	9 (39.13%)	7 (30.43%)	4 (17.39%)	3 (13.04%)	0 (0%)	23
Year 3	1 (12.5%)	6 (75%)	1 (12.5%)	0 (0%)	0 (0%)	8
Year 4	2 (50%)	2 (50%)	0 (0%)	0 (0%)	0 (0%)	4
Total	20 (31.75%)	29 (46.03%)	11 (17.46%)	3 (4.76%)	0 (0%)	63

Table 23. Medical schools should offer curricular and/or extracurricular learning opportunities on robotic surgery

Medical schools should offer curricular and/or extracurricular learning opportunities on robotic surgery						
	Fully disagree [1]	Disagree [2]	Neither agree nor disagree [3]	Agree [4]	Fully Agree [5]	Total
Year 1	0 (0%)	0 (0%)	1 (3.57%)	14 (50%)	13 (46.43%)	28
Year 2	0 (0%)	0 (0%)	2 (8.70%)	11 (47.83%)	10 (43.48%)	23
Year 3	0 (0%)	0 (0%)	0 (0%)	7 (87.5%)	1 (12.5%)	8
Year 4	1 (25%)	0 (0%)	0 (0%)	3 (75%)	0 (0%)	4
Total	1 (1.59%)	0 (0%)	3 (4.76%)	35 (55.56%)	24 (38.10%)	63

4. DISCUSSION

Throughout the study, medical students at the University of Illinois at Chicago expressed a positive attitude towards robotic surgery, and confidence in its performance being more effective than traditional minimally invasive surgery techniques. Though, the students did express some concerns about robotic surgery's effects on surgeons' manual skills.

While almost all medical students who participated in the study were able to correctly identify how robotic surgery is performed, less than a third were able to identify all of the major advantages of robotic surgery, compared to traditional laparoscopic surgery. Through this data, medical students'

knowledge gaps about robotic surgery, because of the lack of a strong resource for information about robotic surgery, were revealed. The addition of robotic surgery into medical school curriculums would be able to fill this gap and educate medical students about the true benefits of robotic surgery, such as improved surgical performance [2, 7].

While a little over half the participants were interested in a surgical career, a vast majority of medical students were interested in robotic surgery being included in class curricula or an extracurricular class. Of the 26 medical students who weren't interested in a surgical career, or unsure of their future career specialty, 23 students said that they wanted medical schools to offer robotic surgery in a curricular and/or extracurricular setting. Demonstrating that there is clear interest in the expansion of robotic surgery in medical schools. Even if a medical student weren't entering a surgical field, the opportunity of the course still remains crucial, especially as robotic surgery is very innovative and may become the future of surgery with its many benefits.

In our study, those who considered themselves tech-savvy were also more compelled to the expansion of robotic surgery in classrooms. This result was anticipated as robotic surgery is one of the most technological procedures.

Although the majority of medical students in the study weren't concerned with surgical robots' effects on surgeons' jobs and professionalism, there was a slight concern with a weakening in surgeons' manual skills. Though, it is unlikely that surgeons will rely solely on surgical robots in the foreseeable future as current robotic systems would be unable to fully replicate the specific, intricate, and adaptable skills that surgeons possess [2].

There are some limitations to this study. The first is the sample size which is related to the shorter study duration. And the second limitation was our sampling. Because our sampling method was convenience sampling, there was a selection bias in the participants. Students who found interest in the poster about robotic surgery and came to the lecture most likely already had a positive interest towards robotic surgery prior to the lecture held.

5. CONCLUSIONS

Even though not many medical students were fully educated on the benefits of robotic surgery and had some concerns about surgical robots' effects on surgeons, they indicated an overwhelming positive attitude and desire for robotic surgery to be added to medical school curricula. There is a need for including robotic surgery in medical school curricula as its benefits to the surgeon and patient are extremely significant. Especially as it continues to quickly expand to all different surgical specialties, robotic surgery will become the future of surgery, and medical students must be educated.

ACKNOWLEDGEMENTS

I would like to thank Dr. Gangemi for being my mentor these last 6 weeks and meeting with me to collect the data and help me organize and analyze it. I would also like to thank Barbara Mera for helping set up the lectures and posters and the 63 medical students who responded to the survey! Finally I would like to thank Mr. Wollschleager for grading all my Primary Resource Analysis worksheets and answering my random questions during the day these two semesters during the summer.

REFERENCES

- [1] F. Marchegiani, L. Siragusa, A. Zadoroznyj, V. Laterza, O. Mangana, C. A. Schena, M. Ammendola, R. Memeo, P. P. Bianchi, G. Spinoglio, P. Gavriilidis, and N. de'Angelis, (2023). "New robotic platforms in general surgery: What's the current clinical scenario?," *Medicina (Kaunas)*.
- [2] K. Reddy, P. Gharde, H. Tayade, M. Patil, L. S. Reddy, and D. Surya, (2023). "Advancements in robotic surgery: A comprehensive overview of current utilizations and upcoming frontiers," *Cureus*.
- [3] H. Singh, H. N. Modi, S. Ranjan, J. W. R. Dilley, D. Airantzis, G.-Z. Yang, A. Darzi, and D. R. Leff, (2018). "Robotic surgery improves technical performance and enhances prefrontal activation during high temporal demand," *Ann. Biomed. Eng.*
- [4] A. Mehta, J. Cheng Ng, W. Andrew Awuah, H. Huang, J. Kalmanovich, A. Agrawal, T. Abdul-Rahman, M. M. Hasan, V. Sikora, and A. Isik, (2022). "Embracing robotic surgery in low- and middle-income countries: Potential benefits, challenges, and scope in the future," *Ann. Med. Surg.*
- [5] S. N. Pai, M. Jeyaraman, N. Jeyaraman, A. Nallakumarasamy, and S. Yadav, (2023). "In the hands of a robot, from the operating room to the courtroom: The medicolegal considerations of robotic surgery," *Cureus*.
- [6] I. Sultan, M. F. Bardi, A. M. Baatta, S. Almaghrabi, and R. A. Mohammed, (2022). "Medical students' attitude towards robotic surgery: A cross-sectional survey," *J. Med. Educ. Curric. Dev.*
- [7] M. J. W. Zwart, L. R. Jones, I. Fuente, A. Balduzzi, K. Takagi, S. Novak, L. A. Stibbe, T. de Rooij, J. van Hilst, L. B. van Rijssen, S. van Dieren, A. Vanlander, P. B. van den Boezem, F. Daams, J. S. D. Micog, B. A. Bonsing, C. Rosman, S. Festen, M. D. Luyer, and D. J. Lips, (2021). "Performance with robotic surgery versus 3D- and 2D-laparoscopy during pancreatic and biliary anastomoses in a biotissue model: Pooled analysis of two randomized trials," *Surg. Endosc.*

AUTHOR

Hillary Liu Sun is currently a senior at Hinsdale Central High School in Hinsdale, Illinois. She has an interest in medicine and plans to major in biology in college, to pursue a career in medicine. Through her school, she's enrolled in the Science Inquiry Research course where she's been studying under mentors and conducting research in the medical field for 3 years. Outside of school, Hillary is involved in a variety of extracurricular activities, such as being on the debate and math team. She also teaches a public speaking class to 4th-7th grade students every Friday. In addition, she volunteers at a local dental clinic, helping patients check in and taking notes for the doctor.

