

Summer anesthesiology externship: Demonstrating the ability of early clinical involvement to educate and increase specialty interest among junior medical students

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Original Article

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Abstract

Background: We describe the influence of a 6-week “Summer Anesthesiology Externship” featuring didactic, procedure, and simulation education on formation of medical students’ specialty choice.

Methods: Eighteen months after externship completion, externs were sent a questionnaire with Likert scale agreement ratings of subspecialties/simulations and yes/no questions about student career interests before/after the program, stipend importance, and procedural skill performance during/after the program.

Results: General anesthesiology had the highest subspecialty approval rating (9.0). Externs strongly agreed that simulations successfully progressed at first year student understanding levels (9.2 mean agreement rating), increased confidence in being part of a care team (9.4 mean agreement rating), and provided personal/interpersonal development. Externs unanimously agreed that the program introduced them to the breadth of anesthesiology, and that practicing clinical/procedural skills improved confidence when performing the procedures later in medical school. Four of 14 students applied for the externship with some focus on anesthesiology as a career choice. After the externship, a significantly higher number of students (12 of 14) were strongly considering applying to the field (p<0.0001). Eleven of 14 ultimately entered anesthesiology residencies, a significantly higher rate than our general medical student classes (p<0.0001).

Conclusions: Both CA1 and CA3 resident post-test scores improved at the end of the ultrasound guided regional workshop. Our study showed a 68% improvement in test scores, which is larger than the 50% improvement previously reported. These results show that fast learning can occur in this type of setting. Furthermore, knowledge acquired during the workshop was retained when CA1 residents were re-tested one year after the workshop. The ultrasound-guided regional anesthesia workshop will become part of the didactic series for our CA1 residents and will be a required learning activity. Additional work still needs to be done to find out the best way to test knowledge and skill outcomes in residents learning new technology and techniques.

Key words: Externship, summer externship, early clinical exposure,

specialization choice

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Introduction

Following completion of the "preclinical" first two years of medical school, third year students typically need to complete mandatory clinical clerkships in surgery, internal medicine, obstetrics/gynecology, pediatrics, family medicine, and psychiatry.¹ Additionally, some medical schools (including our institution) may have further requirements such as emergency medicine, radiology, ambulatory/outpatient medicine, etc. This leaves third year students with little, if any, time for elective study.¹ Even early fourth year students may need to complete a "sub-internship" and/or other mandates. Thus, medical students who discover interest in specialties outside of the core clerkships may have very little time to develop residency applications, and some may even discover their interests after application due dates have passed.

This situation is unfortunate for some students and the fields whose residency training programs they will apply, as several studies indicate that student participation in clinical work can "spark interest" and be a direct source of residency applicants.²⁻⁶ Medical students are left with little time to develop substantial involvement in their future field, jeopardizing the opportunity for deepening of self-education, selection and arrangement of desired visiting clerkships, involvement in advocacy and volunteering (domestic and international), conduction of research (especially long-term) projects, conference attendance/participation, and networking.

Realizing this situation, the Department of Anesthesiology and the Office of the Dean, Stony Brook University School of Medicine, developed and financially co-sponsored an "Anesthesiology Summer Externship" program for medical students between their first and second years. The goal of the program was to provide a six week hands-on, interactive, and educational experience for selected medical students in the field of Anesthesiology. We have outlined the organization, timeline, and goals of the program so that it can be reviewed and modified/replicated by other institutions and departments. We hypothesized that the creation of such a program would be able to successfully introduce junior level (late first year) students to clinical and didactic areas, allowing them to play active care team roles in a field to which they had little prior exposure. We also hypothesized that this kind of active participation may be able to increase interest in Anesthesiology as a future career choice.

Methods

Our study was IRB exempt. The anesthesiology summer externship has been running at our institution for the past seven years, accepting two students annually. The timeline that has been utilized by our program coordinator can be seen in Table 1. Each December an email is sent to the first year medical student class introducing the anesthesiology department and the anesthesiology externship. A brief history and explanation of program goals and expectations are given, and interested students are encouraged to contact previous externs to inquire about their experience. Applicants are given two months to submit applications.

The externship goals and expectations that are sent to prospective students can be seen in Table 2. The program director emphasizes that it is understood that students have little education and

experience in pharmacology and anesthesiology by the end of their first year of medical school. Students are expected to work toward meeting the goals by taking advantage of available instruction and mentoring.

Each student is provided a copy of Stoelting and Miller's *Basics of Anesthesia* for the duration of the externship⁷. Clinical skills are demonstrated by faculty and then practiced in simulation labs and in the operating room under the supervision of a mentor, who can be either a faculty member or a senior (PGY-3 or above) anesthesiology resident. There is no established simulation curriculum, as each simulation is tailored to each student's experience, and thus accounts for variation in fund of knowledge, rotation schedule, and procedural experience. Simulations progress in difficulty as student knowledge and experience develop.

A sample schedule followed by an extern during the program can be seen in Table 3. Students are asked to keep a log of all attempted procedures regardless of success. Students are required to attend all department lectures, grand rounds, and journal clubs. Each extern is provided with a \$2000 stipend, the cost of which is shared between the Dean's Office and Department of Anesthesiology at our institution.

In order to obtain feedback from the students who finish the program, a questionnaire (tables 4 and 5) was designed to assess the educational experience and possible areas of improvement for future participants. A 10 point Likert scale was used to allow for point discrimination of data. The survey was sent out annually via electronic mail about 18 months after externship completion in order to allow the students to have sufficient clinical involvement in their third year of medical school. This was deemed necessary so that they would have the capability to assess their overall relative interest in anesthesiology and the opportunity to perform clinical/procedural skills initially learned as externs.

Although no formal validation process was undertaken, efforts were made to use clearly defined Likert scales, definitive yes/no answers, and unambiguous language to facilitate reproducibility of responses and reliability of data. The questionnaire was created with 3 main parts. The first part involved ratings of the clinical experiences of various externship rotations. These data were primarily used by the program director to ensure that rotations were able to provide high quality educational experiences and to evaluate for potential areas of improvement. The simulation Likert questions were included to evaluate the ability of clinical scenarios to be tailored to first year medical student learning, and to assess the impact of the simulations on the student's perceived confidence and personal/interpersonal development. An accompanying explanatory note was included in the electronic mail which defined the statement as meaning that the simulations "facilitated my sense of how I want my own education to be directed for the remainder of my medical school experience, and aided my ability to professionally interact with other members of a health care team."

The yes/no questions were included to investigate the usefulness of learned clinical skills (we hypothesized students would use the skills regularly in later clinical clerkships), the effect (if any) on student career choice (we hypothesized students may develop interest in the field), and the ability of the program to introduce students to the numerous possible roles and subspecialties of an anesthesiologist.

The Wilcoxon signed rank sum test was used to evaluate for significance in the difference of extern subspecialty approval ratings. Fisher's exact test was used to evaluate for significance in development of interest in anesthesiology as a career choice and likelihood to enter an anesthesiology residency after taking the externship.

Results

All 14 students responded to the questionnaire. Five of 14 students applied for the externship with no focus on anesthesia as a career choice. At the conclusion of the program, 12 of 14 students identified strong interest in the field as a career choice, a significantly higher proportion than the 4 of 14 interested externs at the program's beginning ($p < 0.0001$ based on Fisher's exact test). Further analysis showed that these students who developed interest in anesthesiology were randomly distributed over the program's 7 years, and not clustered within any specific year or group of years. Eleven of 14 externs ultimately entered anesthesiology residency training, while 64 of 763 medical students without an externship entered anesthesiology over the same time period. Medical students therefore were significantly more likely to enter anesthesiology residencies after taking the externship ($p < 0.0001$ based on Fisher's exact test). The 3 externs who did not pursue anesthesiology residencies entered emergency medicine, internal medicine, and diagnostic radiology training.

There was nearly unanimous (13 of 14) agreement about the importance of a stipend to reinforce contractuality. There was universal student agreement that the externship effectively introduced the true breadth of the field to students, and unanimous agreement that the high-frequency, closely-supervised performance of procedural skills increased student confidence in performing these tasks going forward. Thirteen (of 14 possible) externs confirmed that they utilize the skills learned during externship elsewhere in medical school training.

Likert scale questions are seen in table 5. General anesthesiology had the highest mean approval rating (9.0) with the tightest standard deviation (0.9), while subspecialties received varying means and wider standard deviations (cardiac anesthesiology: 7.2 +/- 1.4, pediatric anesthesiology: 8.8 +/- 1.1, obstetric anesthesiology: 8.2 +/- 1.4, acute pain: 7.1 +/- 1.2, chronic pain: 7.3 +/- 1.5). Externs rated general anesthesiology significantly higher than all other subspecialties except for pediatric anesthesiology (all p -values < 0.05 based on Wilcoxon's signed rank test). Externs also rated pediatric anesthesiology significantly higher than cardiac anesthesiology, acute pain, and chronic pain. Obstetric anesthesiology was also rated significantly higher than acute pain and cardiac anesthesiology.

The second Likert scale question examined the efficacy and importance of the simulation exercises. Part A showed that simulations can be effectively tailored and scheduled to coincide with late first year medical student learning (agreement rating mean 9.2 +/- 1.0). Part B showed strong agreement (agreement rating mean of 9.4 +/- 0.7) that simulation can help boost medical students' confidence in participation on a clinical care team. Part C showed agreement (with mean agreement rating of 8.1 +/- 1.1) that simulations can facilitate personal and interpersonal development.

Discussion

Evaluations from our externship program over a 7 year period show externs strongly agreeing that simulations can be successfully tailored to correlate with textbook and clinical learning for any level trainee. The simulations provide a safe and effective means for students to actively participate in their own education/training, a process encouraged by the American Council of Graduate Medical Education (ACGME)⁸ and the Association of American Medical Colleges (AAMC).⁹ Students also strongly agreed (mean agreement rating of 9.4) that the “hands on” approach increased their confidence as part of a clinical care team. Successful simulation navigation mandates student interaction with various mock operating room personnel, stimulating interpersonal development as evidenced by the agreement rating of 8.1 to part C of question 2. The ability of simulations to impact multiple competencies has been previously suggested by several studies, and our data further supports this concept.¹⁰⁻¹¹ The simulation lab also allows students to safely obtain a first-hand experience to further understanding of the tasks, vigilance, and critical role in patient care that the anesthesiologist provides.

The yes/no questions seen in table 5 highlight the importance and implications of the externship. Most (9 of 14) students did have a working idea of specialty choice, suggesting that some were interested in the externship to further develop and reaffirm their career choice (if their pre-existing specialty choice was anesthesiology), or to deepen their knowledge of anesthesia and the workings of an operating room (if their pre-existing field choice was not anesthesiology). The uncertainty of field choice seen in 5 of 14 students suggests that several students used the externship as a means of self-discovery, a popular reason behind selection of elective study.¹²

Interestingly, the majority of externs (10 of 14) began the externship *without* a pre-existing interest in anesthesiology. However, at its conclusion, nearly all (12 of 14) students *were* seriously considering anesthesiology as a career choice, a statistically significant change ($p < 0.0001$). Over time, 11 of the 14 (78.6%) externs ultimately entered anesthesiology residencies, a significantly higher percentage compared to the general medical school classes (75 of 777 students (9.7%), including externs) over the same time period ($p < 0.0001$). This supports the possibility that early exposure can “spark interest” in junior level students who were not explicitly interested prior to the clinical experience. Although the setting was not identical, impact on student interest following early exposure was also seen by the Department of Family Medicine at Ohio State University College of Medicine following implementation of a family medicine summer externship, and the Department of Radiology at the University of Pittsburgh following early student exposure to diagnostic radiology.^{2,4}

The unanimous agreement that the externship successfully shows students the various roles of anesthesiology in patient care may be an important driving force behind the ability of the program to increase student interest in the specialty. The externship showcases the variability of clinical scenarios that can be part of a career in anesthesiology. In this way, it provides a complete vision of all roles an anesthesiologist may perform, which may not be as clear from a 2 or 4 week OR-based anesthesia rotation.

We consider this ability to increase student interest in anesthesia to be important. Students who focus on a career path early in their education have the ability to get involved in their future

fields through the conduct of research projects, advocacy and volunteering, networking, conference attendance, participation in relevant extracurricular activities, and following of relevant journals. During the pursuit of these processes, they can further refine their ultimate career goals, become more competitive residency applicants, and identify mentors. Also, there may be benefit to the public and to the chosen specialty field as future applicants are given more time and opportunities by training programs to "give back" and contribute to the volunteering, academic, technologic, and research efforts mentioned above. This is particularly relevant for those disciplines that are in need of additional residency applicants and future leaders involved in research and advocacy.

Through the course of the externship, students gain experience with practical skills such as real time patient interviews and assessments, emergency management, blood draws and peripheral IV access, acute and chronic blood pressure management, acute and chronic pain management, ventilator functionality, accessing of epidural/subdural space, and much more. Over our 6 week program, externs attempted an average of 45.2 intravenous line placements (SD of 2.3), 20.1 endotracheal intubations (SD of 3.8), 5.2 arterial line placements (SD of 1.3), 4.5 epidural placements (SD of 2.6), and 3.2 spinal placements (SD of 1.1). Familiarity with these skills is important because they are often used in clinical patient care outside of anesthesiology, as shown by nearly unanimous (13 of 14) agreement in question 7 (which assesses utilization of learned procedures in other medical school activities) and other published studies.¹³⁻¹⁵ The expectation for externs to routinely perform their own procedures for their cases (as well as during simulations) reinforces proper educational technique, which is especially important because procedural skills may extinguish over time in students who do not repeatedly practice them.¹⁶

We believe our externship has potential to be developed at other institutions (similar paid anesthesia externships are already in place at the University of Rochester¹⁷ and the University of Maryland¹⁸). The experience can be varied depending on an individual institution's comfort with this level of student-provided patient care, resources available for early clinical training, and faculty committed to success of this kind of education. Our externship runs in June and July (as these are the months when first year medical students are free of educational duties at our institution), a time when new residents are starting and 4th year medical student electives also bring trainees to our department. Our externship director therefore opted to limit the externship to two annual students to ensure that externs receive close, individual attention from the remaining available faculty. A larger institution or a program that has fewer existing educational commitments may be able to support more externs per year. The stipend can be adjusted according to the length of the externship, source of funding, and role of students. However, as evidenced by nearly unanimous (13 of 14) agreement, payment of a stipend has strong implications of contractuality to students and faculty, and allows all students, regardless of financial means, to be able to apply to the externship.

The overnight call responsibilities (our externship requires three) introduces students to off-hours medical/surgical emergencies, participation on a "call team," the need for around-the-clock personnel availability and how limited night time resources impact care delivery. In designing an externship program, the balance of clinical "hands-on" time and self-education time should be given careful consideration. We view this as similar to how the 80-hour work week for residents was designed to limit fatigue and optimize learning.¹⁹

The outlined schedule in Table 3 was constructed to provide students with a sound basis of knowledge in the general operating rooms followed by further learning in subspecialty fields, but the schedule is by no means fixed. Clearly, extern schedules can vary according to availability (and existence) of facilities, specialty departments, teaching attendings/residents, simulation laboratories, and preferred reading materials. In addition, medical school curricula will assuredly vary from our institution, and thus potential program coordinators can optimize didactic education according to the organization of the first year medical school education at their home institution.

While our data is specific for an anesthesiology externship, the overall organization, execution, and implications are by no means limited to the field of anesthesiology. The structure and composition of an anesthesiology externship has been provided to showcase an early exposure framework which may be filled with whichever instructional and clinical duties a department can impart to junior students.

Our relatively small sample size of 14 students somewhat limits the strength of the conclusions that can be drawn from our study. However, data distribution was consistent and without significant clustering over seven years, suggesting that similar results will be yielded in the future. We hope that this report will inspire other institutions to create similar programs so that further study will be possible with larger samples.

Another limitation of our study was the fact that our data only comes from our own institution. While we have no reason to suppose that we are different from other University based departments, we cannot know if faculty from other institutions would be as receptive to train junior level students as are ours. In addition, we cannot know if the externs' interpretation of the questionnaire was consistent and we did not validate questions for interpretation error. However, as explained previously, we did try to minimize differences of interpretation by the usage of clear language, unambiguous answer choices, and explanatory notes where necessary. Also, although questionnaire responses were collected anonymously and honest/open answers were encouraged, it is unclear if the presence of a stipend played any role in the provision of favorable answers (especially question 4 which asks about stipend utility).

The description of our anesthesiology externship is meant to showcase a basic framework of active student participation and exposure early on in medical student education. We have collected data that show the potential of such a program to expose students to new clinical experiences in which they have had little prior instruction. In addition, the externship has been able to interest junior students in the field of anesthesiology and increase student confidence in the performance of procedural skills that are used in multiple fields of medicine. While our program's initial goals were to provide early trainees with clinical exposure in a safe controlled setting, our data suggests that this experience favorably alters students' perceptions of anesthesiology as a desirable field of practice and improves their confidence to perform in a clinical setting. While this specific externship was designed for anesthesiology experience, we suggest that this type of program could be developed in training programs of other disciplines to allow junior trainees insight into themselves and explore possible career paths.

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Tables

Table 1 – Externship Timeline

<p>December: All first year medical students are notified by email about the anesthesiology externship. A brief history is provided to introduce the department and the program. Students are informed of the goals and expectations of the externship, as seen in table 2.</p> <p>February: Students are required to submit a current curriculum vitae and a one page letter of interest to explain why the experience is important for the applicant.</p> <p>March: Externship director reviews the applications and selects well qualified students to interview.</p> <p>April: Externship director then accepts two students, and sends out notification.</p> <p>May: Externship director meets with the students again to gain access to hospital scrubs and OR lockers, obtain proper identification badges and parking permits at all sites that the students will rotate through, and formulate schedules for the students to follow. This allows the externship to start smoothly as soon as students complete final exams.</p> <p>Mid June: Externship begins the week following final exams and runs for six weeks.</p> <p>Late July- Early August: Externship ends. Post-completion questionnaire is sent.</p>

Table 2 –Externship Goals and Expectations**Main Goals:**

- Give the first year medical students exposure to the multiple facets of anesthesiology
- Provide an orientation to patient care in the OR setting
- Provide instruction of basic procedural skills (occasionally requiring sterile technique)
- Provide pharmacologic/physiologic education about the agents and devices typically used by anesthesiologists

Expectations:

- Completion of orientation to operating room personnel, roles, and responsibilities
- Successful rotation through all subspecialties of anesthesia
- Participation in patient care from start of perioperative care including preoperative assessment (inpatients on floor, outpatients in PAT) through intraoperative experience into recovery room or other postoperative disposition and follow up post-op
- Begin to understand the pharmacology of anesthetic drugs with some basic pharmacophysiology including dose response curves, polypharmacy issues, and importance of disease states on drug interactions
- Gain experience with:
 - Placing standard non-invasive monitors and understanding their use and limitations

- Airway management including bag mask ventilation, LMA placement, ETT placement, and reasons for specific airway management choices
- IV placement, site options, size choices, as well as indications and contraindications for IV medications and fluids
- Invasive monitor usage (arterial lines, central venous access), including reasons for and contraindications to invasive monitors
- Begin to understand consciousness as it relates to drugs and anesthesia by learning:
 - Levels of anesthesia
 - BIS monitor functionality, usage and significance
 - Other ways to assess the depth of anesthesia

Table 3 – Sample Extern Education Schedule**Week 1: General Operating Room Anesthesiology (7:00 AM – 5:00 PM)**

- General orientation to operating rooms and its associated roles and rules (since it is very possible that the first year students have not been introduced to the OR setting).
- Beginning knowledge is introduced by lectures, demonstrations, and reading.
- Students should be paired with mentors who are familiar with the program and student inexperience. The mentors should be readily willing to actively teach the students under close supervision.
- Readings should be given that educate the students on basic pharmacologic principles and agents used in the anesthesia setting. The assignments should be suitable to build on an elementary knowledge base since many medical students have not yet received education in pharmacology at the conclusion of the first year (as is the case at our institution).

Week 2: General Operating Room Anesthesiology continued (7:00 AM – 5:00 PM)

- General instruction continues and students are given more autonomy and chances to practice procedural skills such as intubation, peripheral IV access, patient positioning, and LMA placement.
- Tuesday afternoon is reserved for simulation lab with procedure instruction and case simulation. Beginning simulations should be routine cases without complications so as to reinforce student familiarity with the typical preparation, induction, maintenance, and recovery of an anesthetized surgical patient.

Week 3: Cardiac Anesthesiology (6:45 AM – 5:00 PM)

- As knowledge bases become established in the general operating rooms, instruction can transition to focus on cardiovascular anesthesia topics.
- Students should be introduced to topics such as (but not limited to) cardiovascular assessment, cardiovascular monitoring via perioperative echocardiography, Swan-Ganz catheter data interpretation, cardiovascular drug information, cardiac valvular disorders and their relation to the anesthetist, and cardiopulmonary bypass.
- Tuesday afternoon is reserved for simulation lab with procedure instruction and case simulation. Cases should involve cardiovascular anesthesia principles.

Week 4: Labor and Delivery; Pain Management; Radiology Suites; Psychiatry ECT Service;

Research Sites (hours varied depending on service)

- Week is divided among several services in order to give students exposure to the role of anesthesiology in obstetrics, outpatient clinics, radiologic procedures, psychiatric electroconvulsive therapy, and academic research.
- Tuesday afternoon is reserved for simulation lab with procedure instruction and case simulation. Cases should involve lessons learned during the week.

Week 5: Pediatric Anesthesiology (7:00 AM – 5:00 PM)

- Established education is again relied upon as students refine their knowledge base and procedural skills to address the challenges and uniqueness of pediatric anesthesia
- Students should be introduced to topics such as (but not limited to) interaction with the pediatric patient, pediatric airway anatomy and management, pediatric anesthetic

techniques, pediatric medications/pharmacology, and specific procedures that are especially relevant to the pediatric surgical patient.

- Tuesday afternoon is reserved for simulation lab with procedure instruction and case simulation. Cases should involve pediatric anesthesia principles.

Week 6: Independent Selection within Anesthesiology (hours varied depending on service)

- This last week is reserved for the students to pursue personal areas of interest within Anesthesiology.

Weeks 2-6: Students are required to take three overnight (from 5:00 PM to 7:00 AM) “calls” over the final four weeks.

Table 4 – Questionnaire – Likert Scale Questions

1) Please rate your clinical experience from 1-10, 1 being poor, 10 being excellent, in the following rotations:			
General Anesthesiology	1-2-3-4-5-6-7-8-9-10	Mean: 9.0	Standard Deviation: 0.9
Cardiac Anesthesiology	1-2-3-4-5-6-7-8-9-10	Mean: 7.2	Standard Deviation: 1.4
Pediatric Anesthesiology	1-2-3-4-5-6-7-8-9-10	Mean: 8.8	Standard Deviation: 1.1
Obstetric Anesthesiology	1-2-3-4-5-6-7-8-9-10	Mean: 8.2	Standard Deviation: 1.4
Acute Pain	1-2-3-4-5-6-7-8-9-10	Mean: 7.1	Standard Deviation: 1.2
Chronic Pain	1-2-3-4-5-6-7-8-9-10	Mean: 7.3	Standard Deviation: 1.5
2) Simulation Questions			
Please rate your level of agreement from 1-10 for the following statements:			
a) The sequential simulations progressed in a manner that coincided with my learning	1-2-3-4-5-6-7-8-9-10	Mean: 9.2	Standard Deviation: 1.0
b) The simulations helped increase my comfort level as part of the anesthesiology care team	1-2-3-4-5-6-7-8-9-10	Mean: 9.4	Standard Deviation: 0.7
c) The simulations helped my personal and interpersonal professional development	1-2-3-4-5-6-7-8-9-10	Mean: 8.1	Standard Deviation: 1.1

Table 5 – Questionnaire – Yes/No Questions

Question	Responses:	
	Yes	No
1) Did you have an idea for specialty choice prior to the Externship?	9	5
2) Did you strongly consider a career in anesthesiology before doing the Externship program?	4	10
3) Are you strongly considering a career in anesthesiology after doing the Externship program?	12	2
4) Did you feel that the stipend was important to reinforce the contractuality of the externship and your responsibility to contribute to the anesthesia team?	13	1
5) Did the Anesthesiology Externship improve your understanding of the breadth of the field of Anesthesiology?	14	0
6) Did the clinical procedures you performed (IV placement, ETT intubation arterial line placement, etc) during your Anesthesiology Externship increase your confidence in attempting to perform the procedures during 3 rd and 4 th year clerkships?	14	0
7) Were you allowed to perform any of the aforementioned procedures during any other clinical activity during medical school?	13	1