Comparison of multiple training models of surgical rotation for third-year medical students
A prospective study

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AIM: We *decided to compare five different teaching models to provide the best training for third-year medical students during their Surgical Rotation.*
MATERIALS AND METHODS: *Group A got a standard rotation. Group B came to the ward once a week at half morning, spent 1 hour with the tutor and the rest of the morning with residents. Group C was divided into smaller groups, each one assigned 2 times to the ambulatory, to the ward and to the pre-admission service. Group D came to the ward once a week at early morning, spent 2 hours with the tutor and the rest of the morning with residents. Group E was divided in 2 smaller groups that were admitted 3 times in the OR and in the ward. Students filled in an initial and final knowledge-evaluation questionnaire*
RESULTS: *All the Groups showed a positive learning curve. Group B showed the highest improvement (p=0.0001). Group A and Group E showed statistically significant improvements, (p=0.002 and p=0.03). Most of Group A and B students declared that their experience was poor regarding medical examination, while the majority of Group C and E defined their experience satisfactory.*
CONCLUSIONS: *Group B demonstrated the most significant growth and good appreciation from students, but also Group E and Group C showed a high appreciation rate, maybe due to the stimulating activity in the operative room and ambulatory. We propose a synthesis of these models as the best approach, with less crowed groups and ward, ambulatory and OR activities.*

KEY WORDS: General surgery, Medical students, Surgical education, Surgical clerkship, Students training, Surgical rotation

Introduction

It is considered the hardest challenge for medical instructors providing students an adequate experience of the different fields of medicine. In Italy the school of Medicine consists of a six-years course but the schedule of clinical activities varies from one University to another. In our Institution (Sapienza – University of Rome) the clinical experience is provided from the third year with the course of *medical semiotic*. Students are sent to the Department of Surgery for a two months clinical rotation to learn in particular the basis of history and physical examination. However, they often complain of poor learning experience during the surgical rotation. In particular bed-side practical activities have been reported insufficient. Therefore, we decided to set up a study to compare five different approaches and to establish the best teaching model, in terms of both learning progression and students' satisfaction.

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APPENDIX 1

Questionnaire to evaluate students' learning progress

1. What does "dyspnea" mean?
Prolonged apnea
Difficulty in breathing
Hyperventilation
Difficulty in swallowing

2. *The emission of bright red blood from the mouth from the digestive tract is defined as*:
Hematemesis
Hemoptysis
Hemoptoe
Hematochezia

3. *In classical semiotic the "gallbladder spot" is*
A painful spot in acute appendicitis
A painful spot in acute cholecystitis
A painful spot in renal colic
A point in painful chronic cholecystitis

4. *What does "Blumberg sign" mean?*
The abdominal compression elicits pain
The abdominal compression elicits pain, but it is more pronounced when compression is stopped abruptly
The compression does not raise abdominal pain, but it shows up when compression is stopped abruptly
The deep inspiration is abruptly interrupted by palpating the right hypochondrium

5. *Where can you find the Mc Burney's point?*
In the middle of the line that connects the anterior superior iliac spine and the navel
At the intersection of the parasternal line with the iliac-umbilical
Half of the line that connects superior iliac spine to the pubis
At the lateral third of the bisiliac line

6. *Which one of those lines doesn't delimitate and abdominal quadrant:*
Emiclavear line
Parasternal line
Bisiliac line
Subcostal

7. *The cystic artery origins from:*
Hepatic artery
Right hepatic artery
Splenic artery
Superior mesenteric artery

8. *Where does the portal vein origin*:
In front of the pancreatic head, from superior mesenteric vein, inferior mesenteric vein and splenic vein
Behind the pancreatic head, from superior mesenteric vein, inferior mesenteric vein and splenic vein
In front of the pancreatic head, from superior mesenteric vein, umbilical vein and splenic vein
Behind the pancreatic tail, from superior mesenteric vein, inferior mesenteric vein and vena cava

9. *The inferior thyroid artery origins from:*
External carotid artery
Subclavian artery
Thyrocervical trunk
Internal carotid artery

10. *Which of the following is not a part of the medical history:*
Pathological history
Physiological history
General history
Family history

11. *What does strangury mean:*
Daily urinary volume less than 400-500 cc
Frequent urination
Pain during or immediately after urination
Difficulty in urination

12. *Which of the following is not a kind of jaundice:*
Pre-hepatic
Intra-hepatic
Upper-hepatic
Post-hepatic

13. *Which of the following isn't a complication of gallbladder calculus:*
Hepatitis
Pancreatitis
Jaundice
Biliary ileus

14. *Which of the following maneuvers is not part of kidney examination:*
Guyon's
Ballottement
Glenard's
Kocher's

15. *How do you identify the pleural friction rub:*
Manually
With auscultation
Sonografically
Radiologically

16. *When can you find a lower Fremitus:*
Pneumonia
Pulmonary infarction
Atelectasis
Pleural effusion

17. *Courvoisier-Terrier's sign is:*
Jaundice with normal gallbladder
Jaundice with gallbladder increased in volume
Fever and jaundice
Gallbladder with thicker walls

18. *What do you think when you hear metallic bowl sounds:*
Pleural effusion
Ascites
Bowel perforation
Bowel occlusion

19. *What is a pneumothorax:*
Air in the alveoli
Air in the pleural cavity
A forced inspiration
A tracheal fistula

20. *Damoiseau-Ellis line is:*
A curved line, with upper convexity, which represents the percutatory demonstrable upper limit of a pleuritic exudate (dull sound)
A concave line which represents the percutatory demonstrable upper limit of a pleuritic exudate (dull sound)
A curved line, with upper convexity, which represents the percutatory demonstrable inferior limit of a pleuritic exudate (dull sound)
A curved line, with upper convexity, which represents the percutatory demonstrable upper limit of a pleuritic exudate (timpanic sound)

APPENDIX 2

TEST TO EVALUATE STUDENTS' OPINIONS ON THE TEACHING MODEL

1. ***How many hours of the rotation did you actually attend?***
25%
50%
75%
100%

2. ***Taking into account the objectives proposed at the beginning of the rotation, how do you rate your experience?***
Collect medical history of the patient in all its parts and recognize important symptoms according to the disease.
Very poor
Poor
Satisfactorily
Totally satisfactorily

Perform a physical examination of the adult, for each organ and apparatus, and detect normal and pathologic signs of cardiovascular, abdominal, endocrine, urinary and hematopoietic systems.
Very poor
Poor
Satisfactorily
Totally satisfactorily

Learn to use an appropriate language and nonverbal communication, and to change your approach according to the patient attitude.
Very poor
Poor
Satisfactorily
Totally satisfactorily

Learn how to obtain more information from other people (wife/husband, other doctors)
Very poor
Poor
Satisfactorily
Totally satisfactorily

Use appropriate hygiene measures during patient examinations
Very poor
Poor
Satisfactorily
Totally satisfactorily

Examine the patient in a respectfully way, paying attention to cultural, religious and personal aspects
Very poor
Poor
Satisfactorily
Totally satisfactorily

Hypothesize the pathogenesis of the clinical manifestations that you encountered, recognizing causes and induced physical alterations.
Very poor
Poor
Satisfactorily
Totally satisfactorily

Learn to critically correlate medical history, signs and symptoms, imaging and lab exams in simulated or real clinical cases
Very poor
Poor
Satisfactorily
Totally satisfactorily

Choose, interpret the results and the meaning of molecular investigations in different diseases
Very poor
Poor
Satisfactorily
Totally satisfactorily

Learn to keep updated the clinical diary
Very poor
Poor
Satisfactorily
Totally satisfactorily

3. ***Do you think that other topics may be of interest during the surgical rotation and should be included in the Order of Studies?***

4. ***Did the surgical rotation improve your semiotic knowledge?***
Not at all
Poorly
Satisfactorily
Totally

5. ***Did the surgical rotation satisfy your expectations?***
Not at all
Poorly
Satisfactorily
Totally

6. ***Overall, how was "your" clinical rotation?***
Very poor
Poor
Satisfactorily
Totally satisfactorily

7. ***What do you suggest to improve the surgical rotation?***

8. ***Did you ask for a surgical clerkship during or after the surgical rotation?***
Yes
No

9. ***If your answer was yes, please state why.***

Methods

At the beginning of the academic year students were randomly assigned to the surgical departments of our Institution. Twenty-eight students, distributed into five different groups, attended our Department from March through May 2013, and each group had a different tutor (P.A., G.N., D.C, F.DA., M.G.). 4 students were in Group A and underwent a standard clinical rotation, consisting in 5 days spent in the ward with the assigned tutor. 6 students were in Group B and were assigned to the ward once a week; they were expected to arrive at half morning and spend 1 hour with the assigned tutor and the rest of the morning with the residents. Group C was made up of 8 students that were further divided into smaller groups of two people and each group was assigned 2 times to the ambulatory, 2 times to the ward and 2 times to the pre-admission service. 5 students were in Group D and were assigned to the ward once a week; they were expected to arrive at early morning and spend 2 hour with the assigned tutor and the rest of the morning with residents. Finally, 5 students attended Group E and were further divided in two smaller groups that were admitted 3 times in the operative room to assist day-surgery procedures and 3 times in the ward alternatively.

Each student filled in a questionnaire with 20 items on anatomy and medical semiotic topics both at the beginning and at the end of the rotation period, to evaluate the progression (Appendix 1). The items included in the questionnaire were chosen according to the core-curriculum of a third-year Italian medical student, which is different, for example, from the US core-curriculum [1]. They also completed a test to evaluate students' opinions on the teaching model (Appendix 2). Residents (S.A., P.M., N.P., D.S.) were involved in both tutoring activity and data collection and analysis. Comparisons between groups were performed using the Student's t-test. Statistical significance was accepted at the 5% level and statistical trends were accepted at the 10% level.

Results

Learning Progression

For test evaluation, 1 point was assigned for the correct answer, 0 point for wrong or blank answer. Overall, all the Groups showed a positive learning curve (Fig. 1), even if not always statically significant. Group B showed the highest improvement, with an average score of 12 at the beginning of the rotation and a final average score of 19.2 (difference 7.2, p=0.0001). Also Group A and Group E showed a statistically significant improvement. In Group A the initial average score was 9 and the final score 18 (difference 9, p=0.002), while for group E initial and final average score were respectively 10.6 and 14 (difference 3.4, p=0.03). On the other hand, group C and D didn't reach the statistical significance: initial and final average score were respectively 7.4-9.2, and 10-11.6 (differences 1.8 and 1.6, p=0.4 and 0.39).

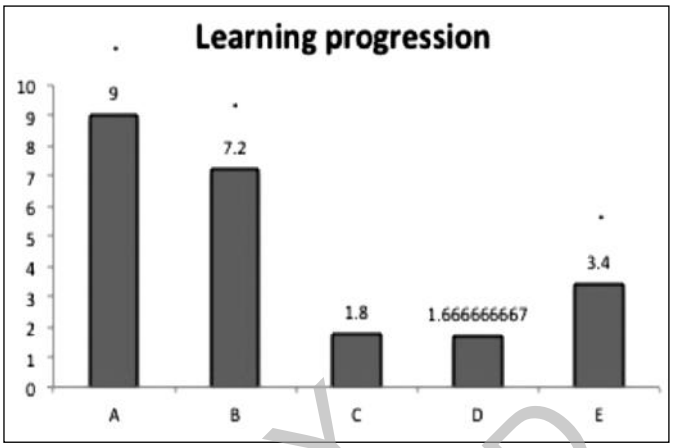

Fig. 1: Learning progression: the average difference between the scores for each group is reported on the top of the columns. The * sign highlights statistically significant results.

Students' Satisfaction

Table I summarizes the results of students' interview at the end of the surgical rotation. However, it's interesting to underline that 100% of Group A and 50% of Group B students declared that their experience was poor regarding medical examination, while 85% of Group C and 100% of Group E defined their experience satisfactory.

Conclusions

The rotation in General Surgery is often the first clinical experience for medical students at our Institution. Therefore, its role is crucial in building skills like patient care and doctor-patient communication. A recent report by Al-Heeti and colleagues [2] demonstrates the impact of general surgery on medical students towards the attitude of choosing general surgery itself as a future career. In particular, in students' perception it moved from the 10th to the 5th ranked position in terms of preference compared with other specialties after a surgical clerkship experience. Moreover, several studies during the last decades have shown that exposure during surgical rotations has a significant impact on student knowledge base and career choices; in particular, Weber and colleagues reported that students rotating on a traditional surgical service maximize learning experiences in the specific fields they are exposed to on that rotation [3]. As a matter of fact, some misconceptions about surgery may influence students in making decisions about their future

TABLE I - *Students' opinion on rotation experience*

Group A	Very Poor	Poor	Satisfactorily	Very satisfactorily
2		100%		
3		100%		
4		100%		
5	33%	66%		
6			33%	66%
7		33%	66%	
8	66%	33%		
9	66%	33%		
10	100%			
11	100%			
12		100%		
13		66%		
14	66%	33%		
Group B				
2			50%	50%
3		66%	33%	
4			100%	
5		50%	50%	
6			50%	50%
7			83%	17%
8		16%	66%	16%
9		66%	33%	
10		100%		
11		33%	66%	
12			50%	50%
13			33%	66%
14			83%	17%
Group C				
2			50%	50%
3		16%	66%	16%
4	17%		50%	33%
5		17%	50%	33%
6		17%	50%	33%
7		17%	17%	66%
8			66%	33%
9			66%	33%
10		50%	17%	33%
11		33%	33%	33%
12		17%	33%	50%
13			33%	66%
14			50%	50%

(*segue*) TABLE I - *Students' opinion on rotation experience*

Group A	Very Poor	Poor	Satisfactorily	Very satisfactorily
Group D				
2			100%	
3	20%	80%		
4		20%	80%	
5	40%	40%	20%	
6	20%	20%	60%	
7			100%	
8			100%	
9	20%	20%	60%	
10		40%	60%	
11	20%	40%	40%	
12		20%	80%	
13		60%	40%	
14		60%	40%	
Group E				
2			25%	75%
3			100%	
4			50%	50%
5			50%	50%
6			50%	50%
7			25%	75%
8			100%	
9		25%	75%	
10		75%	25%	
11			75%	25%
12			25%	75%
13			25%	75%
14			50%	50%

career. Talamini and colleagues reported that a surgical apprenticeship model might provide students with a realistic perspective of surgical practice. In particular, they showed in a statistically significant fashion that students who completed the surgical apprenticeship believe that surgeons are satisfied with career choice, lead a well-balanced lives and encourage the pursuit of surgery as a career. In particular, they believe that surgeons are appropriate role models and provide strong mentorship [4]. Such results confirm the importance of a good planning of students' activities during the rotation, in order to provide a good experience and help medical students in choosing their future career. Unfortunately, we observed that before our study students' experience about surgical rotation wasn't satisfactorily.

Our study has some bias to elucidate. In particular should be pointed out that having a different tutor for each group determinates a confounding issue. Moreover, the randomized distribution of students in the groups doesn't contemplate students' participation to other clerkships on a voluntary basis; therefore, some students may be more aware than others of both clinical and surgical practice. Lastly, we decided not to consider gender differences in our study. The underlying reason for this choice is that compared to few years ago, more and more women are applying for and completing surgical training with excellent results. As an example, in our institution the number of female residents in general surgery is 13 versus 18 male colleagues. Conversely, Park and colleagues in 2005 reported that both real and perceived barriers deter women from a career in general surgery [5]. We believe that gender difference should not be considered in a learning setting, and all students must be compared only on the basis of their knowledge.

Comparing different approaches we found out that Group B demonstrated the most significant growth together with a good appreciation from students. Also Group E and Group C showed a high appreciation rate, due to the stimulating activity in the operative room and ambulatory and subdivision in smaller groups that increased involvement and personal interaction with the tutor. Interestingly, students in group A showed the highest progression in learning, with an average score difference of 9 points, but complained of a poor experience. A plausible explanation of such a result lies on the schedule of this group, which proposes more time spent with the tutor compared to other groups, meaning that they received more lectures. We also may hypothesize that students in this group were highly motivated and therefore they claim for a more intense activity. The results of Group D compared to Group B suggest that the arrival of medical students at early morning and their participation in the morning round may affect the rotation experience. As a matter of fact, third-year students don't have enough information and medical knowledge to actively participate in morning rounds.

Taking into account all those data, we conclude that a synthesis of these models is necessary. The best approach seems to be a setting with less crowed groups (max 3 students), providing stimulating patient-centered activities such as in ambulatory and in the OR, and both faculty and residents to serve as tutors.

An unpredicted outcome of this study was the appreciation of this work expressed by the students themselves, that recognized the attempt to improve their experience: in fact the following year in our Department we observed a triple increase of voluntary clerkships applications. This is consistent with the need of a more student-centered teaching method, which should consider students' feedback and propose a model that improves personal experience without affecting learning outcomes.

Riassunto

Considerata la necessità di elaborare un sistema di rotazione nei reparti di Chirurgia che venga incontro alle necessità degli studenti, abbiamo ideato questo studio prospettico presso la Facoltà di Medicina e Psicologia di "Sapienza, Università di Roma". Nella nostra Istituzione, gli studenti del terzo anno del corso di laurea di Medicina e Psicologia trascorrono un periodo di 2 mesi presso il reparto di Chirurgia Generale per prepararsi all'esame di Semeiotica Medico-Chirurgica. Spesso i feedback di tale esperienza riportano una certa insoddisfazione, soprattutto per la scarsità dell'attività pratica al letto del paziente. Pertanto, abbiamo deciso di confrontare cinque modelli per stabilire il migliore approccio in termini di apprendimento e soddisfazione degli studenti. 28 studenti sono stati coinvolti nello studio e divisi in cinque gruppi (da A ad E). Il Gruppo A ha eseguito una rotazione standard così come prevista dall'ordine degli studi, 5 accessi in reparto seguiti dal proprio tutor. Gli studenti del gruppo B hanno frequentato il reparto una volta la settimana, arrivando dopo la visita della mattina, trascorrendo un'ora con il tutor ed il resto della mattina con gli specializzandi. Il gruppo C è stato diviso in piccoli gruppi, ciascuno assegnato per 2 volte all'ambulatorio chirurgico, 2 volte in reparto (standard) e 2 volte al servizio di preospedalizzazione. Gli studenti del gruppo D hanno frequentato il reparto una volta la settimana arrivando la mattina presto, trascorrendo 2 ore con il tutor ed il resto della mattina con gli specializzandi. Il gruppo E è stato diviso in 2 gruppi, ciascuno assegnato 3 volte al reparto (standard) e 3 volte alla sala operatoria.

Ciascuno studente ha completato un questionario con 20 item di semeiotica all'inizio ed alla fine dello studio per valutare la progressione dell'apprendimento, ed un questionario finale di valutazione della soddisfazione.

I risultati hanno dimostrato come tutti i gruppi abbiano registrato una curva di apprendimento positiva. In particolare, la crescita dei gruppi A ed E è stata statisticamente significativa (p=0.002 and p=0.03)

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References

1. McLean SF, Horn K, Tyroch AH.: *Case based review questions, review sessions, and call schedule type enhance knowledge gains in a surgical clerkship.* J Surg Educ, 13; 70(1):68-75.

2. Al-Heeti KN, Nassar AK, Decorby K, et al.: *The effect of general surgery clerkship rotation on the attitude of medical students towards general surgery as a future career.* J Surg Educ, 2012; 69(4):544-49.

3. Weber SM, Fergestad J, Lewis B, et al.: *How should medical student surgical rotations be structured to optimize education?* J Surg Res, 2005; 126(2):145-48.

4. Reid CM, Kim DY, Mandel J, et al.: *Impact of a third-year surgical apprenticeship model: perceptions and attitudes compared with the traditional medical student clerkship experience.* J Am Coll Surg, 2014; 218(5):1032-37.

5. Park J, Minor S, Taylor RA, et al.: W*hy are women deterred from general surgery training?* Am J Surg, 2005; 190(1):141-6.