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ORIGINAL ARTICLE

Undergraduate basic surgical skills education: impact on attitudes to a career in surgery and surgical skills acquisition

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Abstract
Introduction Basic surgical skills modules in medical education are effective in teaching skills and increasing confidence among students approaching surgery. However, these modules are not delivered universally and their effect on the professional development of graduates has not been established. We aimed to assess the impact of a 10-week basic surgical skills module on attitudes and technical skills of first year medical students compared to interns.
Methods Eighteen students participated and were assessed using a 4-part questionnaire. Technical skills were assessed by observing students perform a basic interrupted suture, using the objective structured assessment of technical skills (OSATS) tool. Fourteen interns were recruited.
Results Students were more confident in surgical scrubbing (mean score 4.0 vs. 2.86, $p = 0.001$), and performing a basic suture (4.05 vs. 1.93, $p = 0.000$), more enthusiastic about assisting with an operation (4.5 vs. 3.0, $p = 0.001$) and more likely to consider a career in surgery (4.16 vs. 2.28, $p = 0.000$). Technical skills were greater in the student group (mean score 30.8 vs. 19.6, $p = 0.001$). Five interns had taken part in surgical skills modules as undergraduates. Their technical skills were significantly higher compared to interns who had not ($n = 9$) (28.8 vs. 14.5, $p = 0.006$), and they were more likely to consider a career in surgery (3.6 vs. 1.5, $p = 0.036$).
Conclusion The introduction of surgical skills teaching to the undergraduate medical curriculum has a positive impact on students' attitudes towards surgery and accelerates basic technical skills development. Consideration should be given to development of a standardised undergraduate core curriculum in basic surgical skills teaching.

Keywords Confidence · Simulation · Surgical career · Surgical education · Suturing

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Introduction

Basic technical surgical skills such as suturing, knot tying and surgical scrubbing have traditionally been taught to undergraduate medical students in the operating theatre, dating back to the "see one, do one, teach one" approach advocated by William Halstead at Johns Hopkins University over a century ago [1]. However, this approach is limited by the conduciveness of the attending surgeons and the theatre staff to teaching [2], as well as more recent issues such as reduced working hours [3], the high cost of malpractice litigation and economic pressures which limit time spent in theatre. Because of the limited opportunities available, students may not receive the required training to achieve competency in basic surgical skills. Indeed, a discrepancy can exist between the confidence level of newly graduated doctors in performing basic surgical skills and the expectations of healthcare stakeholders [4, 5].

For learners to become proficient in these surgical skills, it is imperative that they be acquired in a controlled, safe environment outside of the operating theatre under supervision with feedback and repeated practice [6]. Intern "boot-camps" and undergraduate special study modules in surgical skills have been proven to increase both technical proficiency and confidence levels [7, 8]; however, comprehensive

undergraduate teaching in basic surgical skills has yet to be implemented. This lack of teaching can negatively impact educational opportunities in clinical years as students who have not received formal instruction in basic surgical skills are less confident and less likely to accept an invitation to attend theatre [9]. Unfortunately, this effect can extend into intern year as interns report low confidence in performing basic surgical skills [7]. Early exposure in the pre-clinical years to surgical training and mentorship can have a positive impact on students' attitudes to surgery as a future career [10].

The aim of our study was to assess the impact of 10-week basic surgical skills special study module (SSM) on a group of 18 first year medical students. We aimed to identify the attitudes of students in performing basic surgical skills, assisting in theatre, and a future career in surgery following completion of the SSM and compare this to the attitudes of interns who had completed 9 months of internship. We also assessed and compared the technical skills of the two groups in performing a basic interrupted suture using the objective structured assessment of technical skills (OSATS) tool [11].

Methods

First year medical students attending the National University of Ireland Galway (NUIG) were asked to choose a SSM from a list of 20 available options in September 2016. There were 18 places available for the basic surgical skills SSM, and students were selected by the Programme Director based on short testimonials written by the students explaining the rationale for their preferences. The SSM took place over a 10-week period beginning in January 2016 and was delivered by a group of surgical senior house officers (SHOs) and registrars. Teaching took place for 1 h per week. The curriculum consisted of 2 h of knot tying, 4 h of suturing, 1 h of scrubbing and 1 h on a laparoscopic simulator with basic theory incorporated into each session. Students were examined at the end of the semester in an objective structured clinical examination (OSCE) format in which scrubbing, theory and suturing were assessed. Following written consent, a questionnaire was administered to the students assessing their attitude towards surgery using a 5-point Likert scale (Fig. 1). To assess technical skills, students were asked to perform an uninterrupted suture to close a wound on a synthetic suture pad in 3 min. Performance was assessed by a surgical registrar using the OSATS tool with a total mark out of 35 awarded [11].

An invitation was extended to all interns at the University Hospital Galway (UHG) via e-mail to take part in the study 9 months into their internship. Fourteen interns agreed to take part. They completed the questionnaire and were asked if they had taken part in surgical skills SSMs as students. Interns were assessed performing a basic interrupted suture in the same setting as the medical students.

Data analysis was performed using SPSS version 23 (SPSS Inc., Chicago, IL). Data were assessed for normality using the Shapiro-Wilk test, and parametric or non-parametric tests applied as appropriate. Comparative analysis was performed between the groups. Statistical significance was accepted for $p < 0.05$.

Ethical approval for the study was granted by the Research Ethics Committee of the National University of Ireland Galway.

Results

Eighteen students (12 female, 6 male) and 14 interns (6 female, 8 male) took part in the study.

Mean scores for all four items of the questionnaire were significantly higher in the student group compared to the intern group (Fig. 2). Students were more confident to scrub for theatre (mean score 4.0 vs. 2.86, $p = 0.001$*), more confident in performing a basic suture (4.05 vs. 1.93, $p = 0.000$*), more enthusiastic to assist with an operation if asked (4.5 vs. 3.0, $p = 0.001$*) and more likely to consider a future career in surgery (4.16 vs. 2.28, $p = 0.000$*).

Five of the interns had participated in a surgical SSM as undergraduates. Comparing their questionnaire scores with those of the nine interns who had not taken part in surgical skills SSMs as students, the SSM group were more confident in suturing (mean score 3.0 vs. 1.33, $p = 0.056$), were more enthusiastic about assisting with surgery (3.8 vs. 2.5, $p = 0.076$) and, significantly, were more likely to consider a career in surgery (3.6 vs. 1.5, $p = 0.036$*). The SSM group reported a slightly lower confidence in scrubbing for theatre but this was not statistically significant (2.6 vs. 3, $p = 0.504$) (Fig. 3).

Technical skills assessed by the OSATS tool were significantly higher in the student group compared to the intern group (mean score 30.8 vs. 19.6, $p = 0.001$*) (Fig. 4). Skills were significantly higher in the interns who had taken part in a surgical SSM ($n = 5$) compared to those who had not ($n = 9$) (mean score 28.8 vs. 14.5, $p = 0.006$*) (Fig. 5). OSATS scores were broadly similar between the students and the interns who had taken part in a surgical SSM (30.8 vs. 28.8, $p = 0.568$).

Discussion

Our study highlights the positive impact of a surgical skills module on attitudes towards surgery and technical skills of medical students.

In recent years, an issue has been identified involving the adequacy of medical education and training in preparing doctors for clinical practice, with a lack of preparedness being identified in a number of specialties [12, 13]. The provision of an adequate education in surgical techniques and skills

Fig. 1 Questionnaire assessing attitudes to surgery

Q1 How confident are you to scrub for theatre?

1	2	3	4	5
No confidence	**Not confident**	**Neutral**	**Confident**	**Very confident**

Q2 How confident are you in performing a basic suture?

1	2	3	4	5
No confidence	**Not confident**	**Neutral**	**Confident**	**Very confident**

Q3 How enthusiastic would you be if asked to assist with an operation?

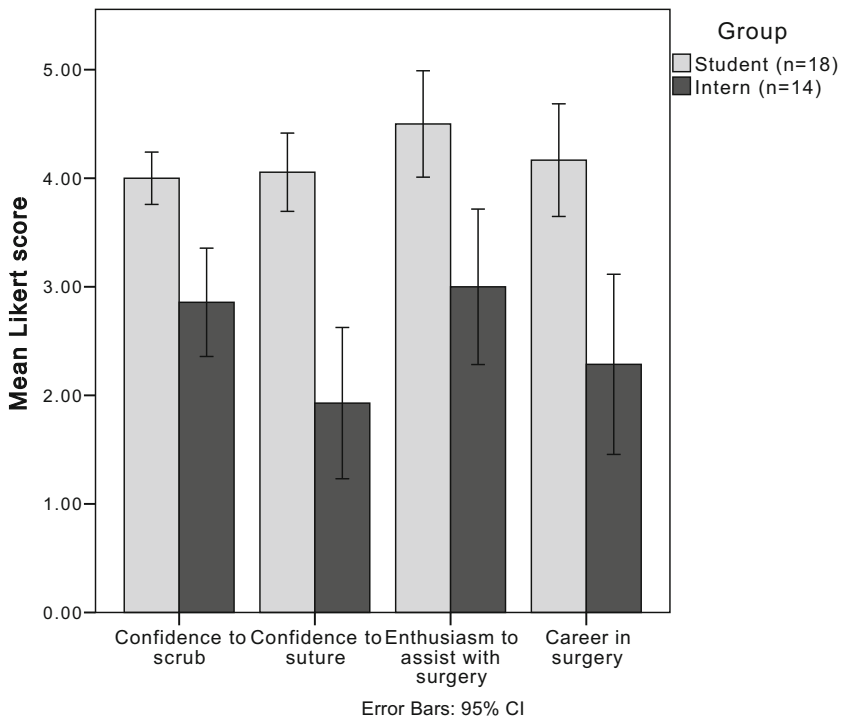
1	2	3	4	5
No enthusiasm	**Not enthusiastic**	**Neutral**	**Enthusiastic**	**Very enthusiastic**

Q4 Would you consider a future career in Surgery?

1	2	3	4	5
No enthusiasm	**Not enthusiastic**	**Neutral**	**Enthusiastic**	**Very enthusiastic**

remains a significant challenge. This can often render students feeling unprepared for clinical practice [7]. A 2016 survey of 705 medical students in the UK found that 86.5% of students felt that the training they had received in suturing was inadequate [14]. Approaches involving surgical clerkships, while beneficial, lack standardisation and an equivocal learning opportunity cannot be guaranteed. The intricacies of learning procedural skills require extensive time on the part of both the students and the teacher. In a theatre setting, where quantity and quality of exposure cannot be ensured, an unfavourable learning outcome can severely compromise both student learning and the students' impression of the profession [15].

Fig. 2 Attitude towards surgery: comparing students vs. interns



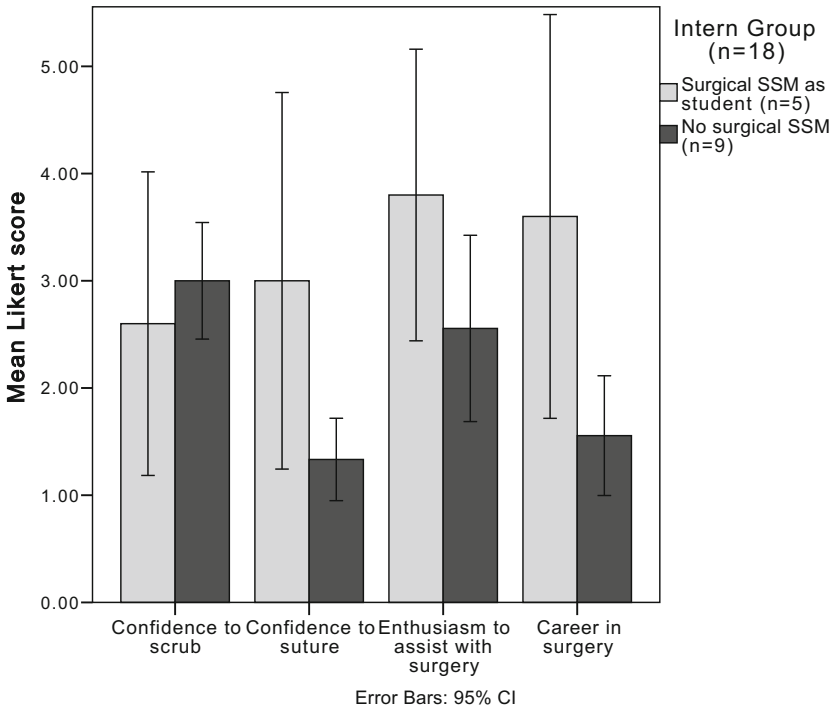


Fig. 3 Attitude towards surgery: comparing interns who had taken part in a surgical SSM as students compared to those who did not

Attending theatre and engaging with surgery is an invaluable educational opportunity offered in medical school. A significant barrier to attending theatre exists for students who have not been educated in scrubbing and gowning. While traditionally this teaching would have occurred in the operating theatre, opportunities to teach students are becoming increasingly rare in the modern hospital. Students in this study were instructed in how to scrub for theatre in a simulated environment by a registrar with deliberate practice and feedback. They responded positively to this formal training and reported high confidence scores in scrubbing and enthusiasm for assisting with surgery after the module.

In terms of basic suturing, opportunities are scarce for medical students to learn and reinforce these skills. At present, formal teaching of suturing is not comprehensively delivered at our institution to undergraduates. Formal education in suturing on bench-top synthetic models offers an appealing and cost-effective option to teach basic suturing skills in a safe

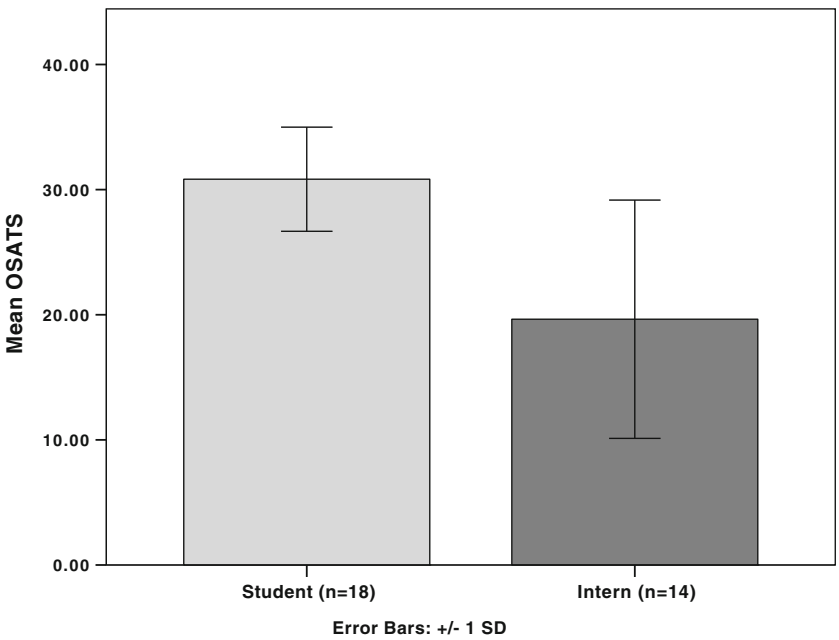


Fig. 4 Surgical skills: comparing students vs. interns

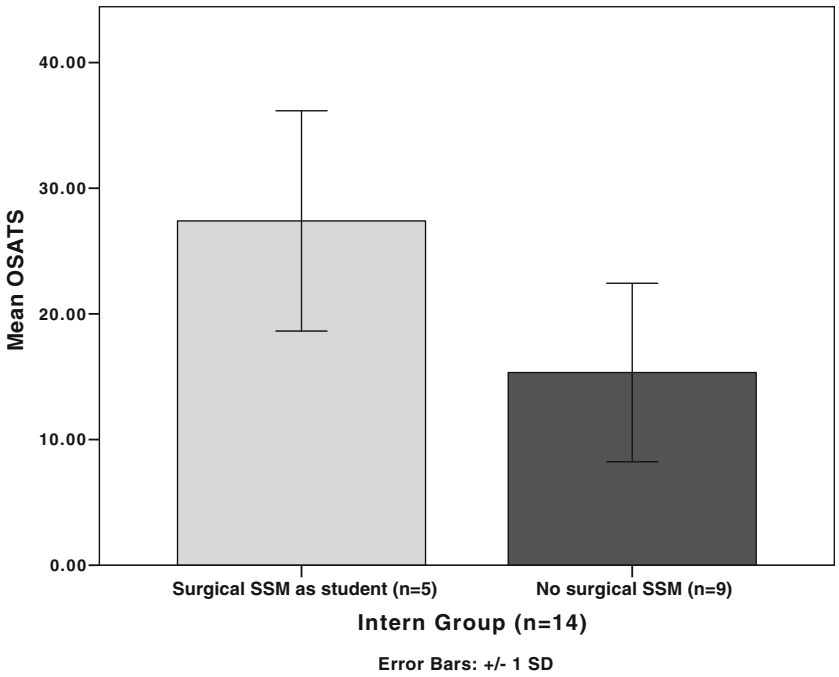


Fig. 5 Surgical skills: comparing interns who had taken part in a surgical SSM as students compared to those who did not

environment with feedback and deliberate practice [16]. Research in cognitive psychology has shown that this process of deliberate practice is effective in establishing professional competence through feedback, reflection and repetition to become fluent in these skills [17]. Our results are in line with an Australian study in which 100 medical students took part in a clinical skills course. Following completion of the course, students were significantly more confident in suturing using a 4-point Likert scale (1.53 before the course, 2.69 after the course) [18]. Students were less anxious and felt better prepared for clinical clerkship after the course. While the students reported a high enthusiasm in considering a future career in surgery (mean 4.16), two students reported a score of 2 (not enthusiastic) following completion of the course. Early exposure of surgical skills and theory may help some students identify that they are not interested in a future career in surgery. This may improve retention rates in surgical specialties.

Basic surgical skills are taught to newly graduated doctors at the beginning of their internship at our institution at "boot-camps", which have proven to be effective in raising confidence levels and competence [7, 18]. However, teaching surgical skills in a concentrated short course may be sub-optimal. Doctors who have been taught surgical skills in a distributive manner over a longer time period retain and transfer skills more efficiently. In a randomised controlled trial in which 38 junior surgical trainees were taught surgical skills either in an intense 1-day course or in a distributive manner with weekly practice, skills were significantly higher in the distributive group. [19]. Interestingly, interns in our study who had taken part in surgical skills SSMs as students scored significantly higher in the OSATS assessment of basic suturing compared to the interns who did not participate in surgical skills SSM. This suggests that surgical skills learned and practiced early in medical school can transfer effectively into clinical practice.

Our study has a number of limitations; firstly, the sample size of both cohorts is small. It may be constructive to extend the study over the coming years with further groups of students and also to conduct a long-term follow-up of the students to identify what impact the module ultimately had on career choice. While the OSATS tool is a reliable and valid tool for evaluating technical skills, it is nonetheless subject to interpretation. Furthermore, the same examiner evaluated both groups performing a basic suture and the potential exists for observer bias. The questionnaire was constructed ad-hoc and could suffer from recency bias as students answered it directly after the course whereas interns may not have performed or practiced scrubbing or suturing in the interval since their intern boot camp. Students who chose to partake in this module would have had an inherent interest in surgery, introducing bias and influencing the results of the study.

Advantages of our study include the prospective design. Questionnaire results were anonymous. This was an inexpensive study using synthetic suture pads and basic surgical equipment.

Conclusion

The findings of our study suggest that students should be offered the opportunity to learn basic surgical skills early and comprehensively in the medical curriculum with the main aim of developing and retaining competence in skills that will

prove beneficial not only as students on surgical rotations but also in the initial years of clinical practice. We should consider expanding the current special study module to afford all students with an interest in surgery to take part. Our study suggests that consideration should be given to addressing the lack of formal basic surgical skills teaching in the current curriculum. A sound background in basic suturing would help students who wish to pursue a career in surgery and also those students who choose careers in emergency medicine or general practice.

In conclusion, our study highlights the positive impact of a basic surgical skills module on attitudes towards surgery and basic surgical skills among medical students. Consideration should be given to offering all students with an interest in surgery comprehensive formal education of basic surgical skills to enhance student's opportunities to engage with surgery and to help meet healthcare shareholders' expectations of newly qualified doctors.

Compliance with ethical standards Ethical approval for the study was granted by the Research Ethics Committee of the National University of Ireland Galway.

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Carter BN (1952) The fruition of Halsted's concept of surgical training. Surgery 32(3):518–527
2. Schwind CJ et al (2004) Variables influencing medical student learning in the operating room. Am J Surg 187(2):198–200
3. Pape H-C, Pfeifer R (2009) Restricted duty hours for surgeons and impact on residents quality of life, education, and patient care: a literature review. Patient Safety in Surgery 3(1):3
4. Ringsted C et al (2001) Medical students' experience in practical skills is far from stakeholders' expectations. Med Teach 23(4):412–416
5. Dehmer JJ et al (2013) Competence and confidence with basic procedural skills: the experience and opinions of fourth-year medical students at a single institution. Acad Med 88(5):682–687
6. Kneebone R (2005) Evaluating clinical simulations for learning procedural skills: a theory-based approach. Acad Med 80(6): 549–553
7. Peyre SE et al (2006) A surgical skills elective can improve student confidence prior to internship. J Surg Res 133(1):11–15
8. Clanton J et al (2014) The relationship between confidence and competence in the development of surgical skills. J Surg Educ 71(3):405–412
9. McMahon DJ, Chen S, MacLellan DG (1995) Formal teaching of basic surgical skills. Aust N Z J Surg 65(8):607–609
10. Erzurum VZ et al (2000) What influences medical students' choice of surgical careers. Surgery 128(2):253–256
11. Martin JA et al (1997) Objective structured assessment of technical skill (OSATS) for surgical residents. Br J Surg 84(2):273–278
12. Burford B, Whittle V, Vance GH (2014) The relationship between medical student learning opportunities and preparedness for practice: a questionnaire study. BMC Med Educ 14:223
13. Moloney BM, McCarthy CE, Byrne D, McVeigh TP, Kerin MJ, McCarthy PA (2017) Teaching radiology to medical students—there is a need for change to better prepare students for clinical practice. Acad Radiol 24(4):506–513
14. Rufai SR et al (2016) A national survey of undergraduate suture and local anesthetic training in the United Kingdom. Journal of Surgical Education 73(2):181–184
15. Saigal P et al (2007) Factors considered by medical students when formulating their specialty preferences in Japan: findings from a qualitative study. BMC Med Educ 7:31
16. Berg DA et al (2007) A cost-effective approach to establishing a surgical skills laboratory. Surgery 142(5):712–721
17. Ericsson KA (2004) Deliberate practice and the acquisition and maintenance of expert performance in medicine and related domains. Acad Med 79(10 Suppl):S70–S81
18. Stewart RA et al (2007) A CRASH course in procedural skills improves medical students' self-assessment of proficiency, confidence, and anxiety. Am J Surg 193(6):771–773
19. Moulton C-AE et al (2006) Teaching surgical skills: what kind of practice makes perfect? A randomized, controlled trial. Ann Surg 244(3):400–409