Exploring correlation between early clinical skills teaching and self-reported competence of senior medical students; a cross-sectional study

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ABSTRACT: Introduction: Simulation-based teaching combined with supervised clinical practice, are the necessary steps for safe and systematic clinical skills education. Building medical students' self-esteem during their undergraduate studies has a positive effect in their competence but is not sufficient to ensure successful clinical skills performance. The aim of the study was to assess senior medical students' self-reported competence before graduation in basic clinical skills and explore potential correlations with early simulation-based clinical skills teaching. **Methods:** We conducted a cross-sectional study in final-year medical students one month before their graduation. We invited senior medical students to self-report their competence in 42 basic clinical skills using an online anonymous questionnaire. Medical students' participation in the clinical skills lab (CSL) elective course was the main factor of analysis. **Results:** Senior medical students' response rate in our electronic study was 24.6%. Thirty-four students (38.6%) have attended CSL elective course. Attending CSL seemed to influence senior medical students' self-reported competence in performing the 15 skills taught in the elective course in comparison with students who have not attended it ($p > 0.05$). There was no statistical difference between the two groups in regard to other basic skills that were not taught in the CSL. **Conclusion:** Our results indicate that senior medical students do not feel competent enough to perform basic clinical skills that the undergraduate medical curricula should cover. Systematic clinical skills teaching in early years of medical studies before patient contact seemed to be enough to change senior medical students' self-reported competence in specific clinical skills.

Keywords: Clinical skills, self-reported competence, undergraduate medical education

INTRODUCTION

A successful undergraduate medical curriculum should ensure that graduates have the appropriate knowledge, skills, attitudes and professional identity to begin their residence[1,2]. According to "Tomorrow's Doctors: Outcomes and standards for undergraduate medical education", medical schools have the duty to provide safe and systematic clinical skills teaching to all undergraduate medical students. Teaching should start in a safe simulated environment and then transfer in real clinical environment under supervision[3,4]. Therefore, clinical skills education should be safe both for patients and medical students[5,6].

Basic clinical skills are essential to medical students[7,8]. Studies suggest that many curricula fail to fulfil this objective, leading to inadequate skills acquisition of medical graduates[2,5,6]. Many junior doctors

have to practice skills that they were not properly prepared for, exposing their patients in potential harm[5].

Traditionally, clinical skills teaching takes place during clinical placements with the informal approach of "see one, do one, teach one"[9]. Another major clinical education's drawback is students' late exposure to patient interactions[10]. Pre-clinical years mean to prepare students for a smooth transition to clinical years[11]. Early patient interactions help ease the transition from preclinical to clinical education, motivate students and teach them responsibility, accountability, empathy and professionalism[10].

Clinical placements are a vital part of successful clinical medical education[9]. Students all over the world indicate inadequacy of clinical supervision and feedback during their placements [11,12]. Although many scientific boards[3,4] have set clinical skills lists that medical graduates should acquire during their education, it is uncertain students actually observe and perform them during clerkships[2]. Lack of clear objectives about clinical skills education is the main reason for this inconsistency[13,14]. Patient safety movement had a clear influence in diminishing the opportunities to learn and practice in clinical environment. Systematic simulation-based teaching and supervised clinical practice will help solve the problem[15,16].

Different curricula approaches suggest that clinical skills laboratories, clinical supervision and problem-based learning better prepare students for skills performance in their clerkships[2,6]. Medical students should practice clinical and communication skills in a safe environment before their practice with real patients[17].

Clinical skills laboratories provide a safe educational environment where students can learn wide range of skills in a self-directed pace getting immediate feedback. These laboratories can never replace real clinical environment and patient interactions. However, they enable medical students to better learn basic clinical skills, helping boost their self-confidence and better perform in clinical environment[5,16,17].

Building medical students' self-esteem during their studies is very important. Although it is not sufficient for successful clinical skills performance, it helps develop their competence and gradually improve it. It is noted that students with low self-reported competence tend to avoid performing tasks and dwell on their weaknesses[18].

In this study, we aimed to assess self-reported competence of senior medical students in basic clinical skills before graduation and explore potential correlation with early simulation-based clinical skills teaching.

METHODS

Clinical Skills Teaching in Medical School of Aristotle University of Thessaloniki

Medical School of Aristotle University of Thessaloniki (AUTh) has a traditional six-year medical curriculum divided in preclinical and clinical courses. First student - patient encounter takes place in the third year of studies when clinical courses start. Senior medical students have clinical clerkships in hospitals and General Practice. Clinical skills teaching in a hospital environment has restrictions well described in recent publications[9,19-24].

In 2005 an elective course, called "Clinical Skills Laboratory" (CSL), was introduced in the second year of studies, aiming to improve clinical skills education in AUTh medical school.

Seminars and labs compose CSL elective course's program. Two seminars introduce medical students in basic principles of communication skills and infection control. Small groups of six medical students participate in nine two-hour labs about hand washing, medical history, head-to-toe clinical examination, vital signs, injections, venepuncture, male and female urinary catheterization, skin suturing and airway management. Medical students have the opportunity to practice skills in two revising sessions before taking an OSCE exam.

Sixty out of 350 medical students (17.14%) have the opportunity to attend CLS course annually due to staff and resources limitations. As a result, a sufficient number of students perform clinical skills for the first time on real patients, without previous experience and with minimum supervision, endangering patient safety.

Study design and population

We conducted a cross-sectional study in AUTh Medical School. The population of the study was all (357) medical graduates of the academic year 2014-2015.

Study tool

We used an online anonymous questionnaire assessing different aspects of clinical skills education in AUTh Medical School. Aim of this questionnaire was to detect the clinical skills a medical curriculum should include.

A scientific team consisting of academic staff - clinicians working in university hospitals, medical doctors and nurses - members of AUTh CSL designed the ques-

tionnaire. After three meetings and a thorough review of literature, the scientific team concluded to a 42 clinical skills list that was included in the survey. We took into account "Tomorrow's Doctors" list of practical procedures for medical graduates[3], Scottish doctor learning outcomes[25] and the current medical curriculum in AUTh Medical School to create the final list of clinical skills (Table 1).

The two-section questionnaire contained close-ended questions. First section included demographic data such as gender, age, participation in "CSL" course or other similar seminars and degree from other health care related schools. Second section included data about students' self-reported competence in 42 different basic clinical skills, measured in a 3-point scale (1 = I can, 2 = I cannot, 3 = I can, with help).

Clinical skills were categorized as diagnostic procedures (e.g. measuring vital signs, taking blood cultures), therapeutic procedures (e.g. skin suturing, blood transfusion,), general skills (e.g. hand washing, safe disposal of clinical waste) and communication skills (e.g. working in a team, obtaining consent).

Table 1. *List of clinical skills*

Diagnostic procedures	Therapeutic Procedures	Communication and infections control skills
Taking patient' s Medical History	Basic techniques of airway management (ventilation techniques etc.)	Professionalism (respect the autonomy of patients, respect patient' s medical confidentiality)
Measuring vital signs (blood pressure, pulse rate, body temperature, oxygen saturation)	Establishing peripheral intravenous access and setting up an infusion; use of infusion devices	Communication skills with patients and relatives (bad news announcement, management of difficult patients or patients from different cultural background)
Managing blood samples correctly		
Measuring and interpreting blood glucose	Preparing and administrating drugs using different ways of administration (intramuscular, subcutaneous, intravenous injection, inhaled medication)	Communication skills with other health professionals, working in a team
Taking cultures (blood, urine, coating from pharynx, nose and skin) for testing	Blood transfusion	Informing patients about modifiable risk factors (alcohol, smoking, nutrition. exercising)
Performing and interpreting a 12-lead electrocardiograph (ECG)	Male and female urinary catheterization andscreening tests (test Pap)	Observation and presentation of imaging tests (x-ray, CT, MRI) to the patient
Basic respiratory function tests	Use of local anaesthetics	Observation and presentation of intrusive diagnostic procedures to the patient
Urine multi dipstick test	Skin suturing	
Pregnancy testing	Wound care and basic wound dressing	Prescription of a medical recipe
Clinical Examination	Correct techniques for 'moving and handling' patients	Documentation (discharge note, death certificate)
Examination using special equipment (ophthalmoscope, otoscope, colposcope)	Observation and participation in a delivery procedure	Giving information about the procedure, obtaining and recording consent
ABCDE assessment of a critically ill patient	Cardiopulmonary resuscitation using automated external defibrillator	Hand washing and use of personal protective equipment (gloves, gowns, masks)
Interpretation of basic imaging tests (x-ray of chest/abdomen)	Special cardiopulmonary resuscitation (drug administration. defibrillation)	Safe disposal of clinical waste, needles and other 'sharps'
Health needs assessment and decision making	Dealing with foreign body airway obstruction	
	Pneumothorax drainage techniques	
	Levin tube insertion	
	Observation of therapeutic procedures (abscess drainage)	
	Management of diagnostic and therapeutic uncertainty and taking therapeutic decisions	

Procedure

We invited all senior medical students to participate in this study via e-mail, a month before their graduation, sending them a unique personal anonymous de-identified link to the questionnaire to guarantee anonymity. A reminder e-mail was sent to non-responders a week after the initial e-mail.

Statistical analysis

Data analysis was performed using SPSS v.21 software package. We calculated the frequency distribution and percentage of the variables. We computed a score variable from the variables of clinical skills taught in "CSL" (15 different variables). We applied a Mann Whitney test in the computed data to examine the difference between means of graduates who have participated in the "CSL" and those who have not, at a $p < 0.05$ level of significance.

RESULTS

Eighty-eight senior medical students answered the questionnaire. The response rate of the study was 24.6%, which is valid for online surveys[26]. Forty-five students (51.1%) were female. The mean age of the students was 26.5– 2.57 years, ranging from 25 to 47 years. Only 2 students (2.3%) had a prior degree from another healthcare related School (e.g. nursing diploma). Thirty-four students (38.6%) have attended the "CSL" elective course and from the remaining fifty-four, nineteen (21.6%) have never had any kind of clinical skills teaching (e.g. "CSL" elective course, BLS/AED or other seminar) during their undergraduate medical education.

Senior students, regardless of their previous clinical skills education, claimed they were competent enough to perform 22 out of 42 basic clinical skills included in the study (supplement tables 1-3). "Taking a patient's medical history" was the diagnostic procedure with the highest "I can" score (98.9%), while "Basic respiratory function tests" was the procedure with the lowest "I can" score (20.5%). "Wound care and basic wound dressing" was the therapeutic procedure with the highest "I can" score (84.1%), while 3.4% of the students claimed they could perform "Blood transfusion". "Hand washing and use of personal protective equipment (gloves, gowns, masks)" and "Safe disposal of clinical waste, needles and other sharps" were two procedures with high "I can" score (88.6% and 85.2% respectively). "Professionalism" gathered a high "I can" score

(87.5%), while 20.5% of the students reported they could perform "Observation and presentation of invasive diagnostic procedures to a patient".

Attending "CSL" elective course had a positive influence in self-reported competence in 12 out of the 15 clinical skills even though only three had a significant difference ($p > 0.05$) (Table 2). The global self-reported competence rate for all 15 skills taught in the CSL course was significant between senior students who attended the CSL course and those who have not attended it (non-CSL group) ($p > 0.05$) (Table 3).

There was no significant difference between the two groups in regard to the other 26 skills that were not taught in the "CSL" elective course, with the exception of "levin tube insertion" (supplement table 4).

DISCUSSION

Main Findings

Comparing senior medical students, who have attended the "CSL" course with students who have not, revealed a difference in self-reported competence. "CSL" teaching lasts one semester (third semester of studies) and does not aim to cover the full range of clinical skills medical students should acquire during their undergraduate medical education. Academic staff availability and lack of teaching facilities were the main reasons why "CSL" could not cover all medical students' educational needs at the moment of this study. However, this short but systematic way of teaching clinical skills before patient contact seemed to influence senior medical students' self-reported competence in performing the specific skills. We can attribute this difference to the fact that students receiving systematic clinical skills teaching develop a richer conceptualization of skills, which helps them build their self-esteem[27].

Our results also indicate that senior medical students, regardless of their previous clinical skills education, are not confident enough to perform basic diagnostic, therapeutic, general and communication skills. The majority of medical students claim they can perform clinical skills with help from a senior healthcare professional (i.e. nurse, intern or a specialized doctor). Although senior medical students are not expected to be competent enough to perform difficult or specialized clinical skills (e.g. pneumothorax drainage techniques or special cardiopulmonary resuscitation)[9], low self-reported competence rates in performing basic clinical skills, such as drugs administration or urinary catheterization is not expected. Chen et al. (2008) came to si-

Table 2. *Senior medical students' self-reported competence in performing the 15 skills taught in the "CSL" elective course*

	N	Attended "CSL"			N	Not Attended "CSL"			Sig.
		I can n (%)	I can with help n (%)	I cannot n (%)		I can n (%)	I can with help n (%)	I cannot n (%)	
Taking patient's medical history	34	34 (100.0)	0 (0.0)	0 (0.0)	54	53 (98.1)	1 (1.9)	0 (0.0)	0.61
Measuring vital signs (blood pressure, pulse rate, body temperature, oxygen saturation)	34	34 (100.0)	0 (0.0)	0 (0.0)	54	52 (96.3)	2 (3.7)	0 (0.0)	0.37
Managing blood samples correctly	34	29 (85.3)	4 (11.8)	1 (2.9)	54	36 (66.7)	18 (33.3)	0 (0.0)	0.04
Performing clinical examination	34	33 (97.2)	1 (2.8)	0 (0.0)	54	48 (88.9)	6 (11.1)	0 (0.0)	0.17
Examination using special equipment (ophthalmo-scope, Otoscope)	34	21 (61.8)	13 (38.2)	0 (0.0)	54	22 (40.7)	31 (57.4)	1 (1.9)	0.13
Therapeutic Procedures Basic techniques of airway management (ventilation techniques etc)	34	23 (67.6)	8 (23.6)	3 (8.8)	54	23 (42.6)	24 (44.4)	7 (13.0)	0.07
Establishing peripheral intravenous access and setting up an infusion; use of infusion devices	34	15 (45.5)	16 (47.1)	3 (8.8)	54	18 (33.3)	24 (44.4)	12 (22.2)	0.24
Preparing and administra-ting drugs using different ways of administration (IM, SC, IV injection, inhaled medication)	34	19 (55.9)	14 (41.2)	1 (2.9)	54	23 (42.6)	23 (42.6)	8 (14.8)	0.16
Male and female urinary catheterization	34	25 (73.5)	7 (20.6)	2 (5.9)	54	23 (42.6)	23 (42.6)	8 (84.8)	0.02
Use of local anaesthetics	34	26 (76.5)	7 (20.6)	1 (2.9)	54	35 (64.8)	18 (33.3)	1 (1.9)	0.43
Skin suturing	34	2533 (73.5)	9 (26.5)	0 (0.0)	54	34 (62.9)	17 (31.5)	3 (5.6)	0.30
General & Communication procedures Professionalism (respect of the autonomy of the patient, respect the patient's medical confidentiality)	34	29 (85.3)	5 (14.7)	0 (0.0)	54	48 (88.9)	6 (11.1)	0 (0.0)	0.43
Communication skills with patients and relatives (bad news announcement, management of difficult patients)	34	20 (58.8)	13 (38.3)	1 (2.9)	54	34 (62.9)	19 (35.2)	1 (1.9)	0.90
Hand washing and use of personal protective equipment (gloves, gowns, masks)	34	30 (88.2)	4 (11.8)	0 (0.0)	54	48 (88.9)	6 (11.1)	0 (0.0)	0.59
Safe disposal of clinical waste, needles and other 'sharps'	34	33 (97.1)	1 (2.9)	0 (0.0)	54	42 (77.8)	11 (20.3)	1 (1.9)	0.05

Table 3. *Comparison of global self-reported competence rate in performing the 15 skills taught in the CSL elective course between medical students that attended and not attended the CSL class*

| Procedure | N | Global senior medical students' self-reported competence rate | | Asymp. Sig. (2-tailed) |
		Mean Rank Attended "CSL"	Mean Rank Not attended "CSL"	
I can	88	52.32	39.57	0.02
I can with help	88	38.34	48.38	0.04
I cannot	88	37.63	48.82	0.04

milar conclusions in their study, where a significant numbers of students did not feel confident enough to insert an intravenous catheter or perform a venipuncture[9].

Graduates in our study felt they were competent enough to perform 48.8% of the skills listed in the questionnaire. Chen et al. (2008) found similar results, since 60% of their students were confident enough to perform only 4 out of 17 skills examined[9]. Contrary to this, Abadel & Hattab (2013) state that only 12.4% of their medical graduates felt their clinical competency was inadequate, considering this finding a result of the curriculum change which exposes medical students to supervised training during their clerkships[1].

Strengths of the study

This study examined senior medical students' self-reported competence in basic clinical skills but also explored potential correlations between self-reported competence and clinical skills teaching in a simulated environment, four years before graduation. There are no known studies in the literature that address this outcome.

Simulated-based education can create a false sense of competence to medical students, which declines after their first contact with real patients[18]. Aiming to eliminate this, we examined senior medical students' self-reported competence after the completion of their clinical placements and patient contacts.

Limitations of the study

The study examines senior medical students' self-reported competence and not actual tested competence. Self-reported competence has known problems concerning validity and reliability[9,13,28,29]. Students who claim they "CAN" do a clinical skill does not actually mean they can. Thus actual skills acquisition cannot be proven in this study.

This was an online survey making data gathering faster, easier, with minimal cost and automation in data input and handling (which minimizes data errors). Even though online questionnaires offer participants the opportunity to answer in their own pace, chosen time and preferences[26] the response rate is not equivalent to printed ones.

The study may have a selection bias, since senior medical students could select whether to participate in the study. Enhanced responsiveness among students who have attended the CSL may have led to overestimation of the effectiveness of the CSL curriculum as estimated by the self-reported competence. Another drawback is the recall bias, since students had to rely on memories while completing the questionnaire.

Implications

The results of this study indicate that simulation-based education may be a good start for improving medical students' self-reported competence. Clinical skills teaching has to start early in the curriculum in a systematic and continuous way, covering the full range of basic clinical skills[30-32].

Our study confirms the need for effective and systematic clinical skills teaching in a simulated environment before first patient conduct, securing patient safety. Clinical skills centers where students can develop a wide variety of skills, in a safe and protected environment, provide the best teaching choice for medical schools[5,31]. Simulated-based teaching combined with supervised hands-on practice in real patients during clinical placements are essential conditions for clinical skills development.

This study should motivate the needed changes in clinical skills education in medical schools with traditional curricula. It is an opportunity for AUTh medical school to adopt the clinical skills bundles (diagnostic, therapeutic infections control and communication

skills) the scientific team proposes and integrate this systematic clinical skills education in the undergraduate medical curriculum. Clinical skills education should start with basic clinical skills teaching in a simulated environment in the first year of studies and gradually advance in real conditions, without losing the communication with the CSL. After all, clinical skills are the cornerstone of medical education[19].

Διερεύνηση της συσχέτισης μεταξύ της πρώιμης εκπαίδευσης κλινικών δεξιοτήτων και της αυτο-αναφερόμενης ικανότητας επιτέλεσης τους από φοιτητές ιατρικής μεγαλυτέρων ετών. Μια συγχρονική μελέτη.

Εμμανουήλ Σμυρνάκης, Μαρία Μοιρασγεντή, Φρειδερίκη Σηφάκη, Απόστολος Τσάπας

Εισαγωγή: Η εκπαίδευση σε συνθήκες προσομοίωσης σε συνδυασμό με την πρακτική άσκηση υπό επίβλεψη σε πραγματικούς ασθενείς, αποτελούν δύο απαραίτητα βήματα για την ασφαλή και συστηματική εκπαίδευση στις κλινικές δεξιότητες. Η οικοδόμηση της αυτοεκτίμησης των φοιτητών ιατρικής κατά τη διάρκεια των σπουδών τους είναι ζωτικής σημασίας, αλλά δεν αρκεί για να εξασφαλίσει την επιτυχή πραγματοποίηση κλινικών δεξιοτήτων. Ο σκοπός της μελέτης ήταν να αξιολογήσει την αυτο-αναφερόμενη ικανότητα σε βασικές κλινικές δεξιότητες φοιτητών μεγαλυτέρων ετών της ιατρικής, πριν από την αποφοίτησή τους και να διερευνήσει πιθανές συσχετίσεις με την πρώιμη εκπαίδευση κλινικών δεξιοτήτων σε συνθήκες προσομοίωσης. **Μέθοδος:** Πραγματοποιήσαμε μια συγχρονική μελέτη σε τελειόφοιτους φοιτητές ιατρικής ένα μήνα πριν από την αποφοίτησή τους. Καλέσαμε τους φοιτητές να κάνουν την αυτοεκτίμηση των ικανοτήτων τους σε 42 βασικές κλινικές δεξιότητες χρησιμοποιώντας ένα ανώνυμο ερωτηματολόγιο μέσω διαδικτύου. Τα δεδομένα αναλύθηκαν λαμβάνοντας υπόψη την προηγούμενη συμμετοχή των φοιτητών στο επιλεγόμενο μάθημα «Εργαστήριο Κλινικών Δεξιοτήτων» (ΕΚΔ). **Αποτελέσματα**: Η απαντητικότητα των τελειόφοιτων φοιτητών ιατρικής στην ηλεκτρονική μας μελέτης ήταν 24,6%. Τριάντα τέσσερις φοιτητές (38,6%) είχαν παρακολουθήσει το επιλεγόμενα μάθημα ΕΚΔ. Η παρακολούθηση του ΕΚΔ φάνηκε να επηρεάζει την αυτοεκτίμηση της ικανότητας των φοιτητών στην πραγματοποίηση των 15 δεξιοτήτων που διδάσκονται στο επιλεγόμενο μάθημα, σε σχέση με τους φοιτητές που δεν το έχουν παρακολουθήσει (p> 0,05). Δεν υπήρχε στατιστικά σημαντική διαφορά μεταξύ των δύο ομάδων φοιτητών σε σχέση με τις άλλες βασικές δεξιότητες που δεν διδάχθηκαν στο ΕΚΔ. **Συμπεράσματα**: Τα αποτελέσματά μας δείχνουν ότι οι τελειόφοιτοι φοιτητές ιατρικής δεν αισθάνονται αρκετά ικανοί να επιτελέσουν τις βασικές κλινικές δεξιότητες που πρέπει να καλύπτει το προπτυχιακό πρόγραμμα σπουδών της ιατρικής. Η συστηματική εκπαίδευση στις κλινικές δεξιότητες στα πρώτα χρόνια των ιατρικών σπουδών πριν από την επαφή με τους ασθενούς φαίνεται να είναι αρκετή για να αλλάξει την αυτοεκτίμηση των τελειόφοιτων φοιτητών ιατρικής στην πραγματοποίηση επιλεγμένων κλινικών δεξιοτήτων.

Λέξεις Κλειδιά: κλινικές δεξιότητες, αυτοεκτίμηση ικανότητας, προπτυχιακή ιατρική εκπαίδευση

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Supplement Tables

Supplement Table 1. *Senior medical students self-reported competence in diagnostic procedures*

Diagnostic Procedure	N	I can n (%)	I can with help n (%)	I cannot n (%)
Taking patient' s Medical History	88	87(98.9)	1(1.1)	0(0.0)
Measuring vital signs (blood pressure, pulse rate, body temperature, oxygen saturation)	88	86(97.7)	2(2.3)	0(0.0)
Managing blood samples correctly	88	65(73.6)	22(25.3)	1(1.1)
Measuring and interpreting blood glucose	88	79 (89.7)	9(10.3)	0(0.0)
Taking cultures (blood, urine, coating from pharynx, nose and skin) for testing	88	33(36.8)	42(48.3)	13(14.9)
Performing and interpreting a 12-lead electrocardiograph (ECG)	88	35 (39.8)	47(53.4)	6(6.8)
Basic respiratory function tests	88	19(20.7)	41(47.1)	28(32.2)
Urine multi dipstick test	88	62(70.5)	24(27.2)	2(2.3)
Pregnancy testing	88	39(44.3)	22(25.0)	27(30.7)
Clinical Examination	88	81(92.0)	7(8.0)	0(0.0)
Examination using special equipment (ophthalmoscope, otoscope, colposcope)	88	43(48.9)	44(50.0)	1(1.1)
ABCDE assessment of a critically ill patient	88	44(50.0)	40(45.5)	4(4.5)
Interpretation of basic imaging tests (x-ray of chest/abdomen)	88	37(42.0)	51(58.0)	0(0.0)
Health needs assessment and decision making	88	54(61.4)	32(36.4)	1(1.1)

Supplement Table 2. *Senior medical students self-reported competence in therapeutic procedures*

Therapeutic Procedure	N	I can n (%)	I can with help n (%)	I cannot n (%)
Basic techniques of airway management (ventilation techniques etc)	88	46 (52.3)	32 (36.3)	10 (11.4)
Establishing peripheral intravenous access and setting up an infusion; use of infusion devices	88	33 (36.0)	40 (46.5)	15 (17.5)
Preparing and administrating drugs using different ways of administration (intramuscular, subcutaneous, intravenous injection, inhaled medication)	88	42 (47.7)	37(42.1)	9(10.2)
Blood Transfusion	88	3(3.4)	23(26.1)	62(70.5)
Male and female urinary catheterization	88	48 (54.5)	30 (34.1)	10 (11.4)
Use of local anaesthetics	88	61 (69.3)	25 (28.4)	2(2.3)
Skin suturing	88	59 (67.0)	26 (29.6)	3(3.4)
Wound care and basic wound dressing	88	74 (84.1)	14 (15.9)	0(0.0)
Correct techniques for 'moving and handling' patients	88	16 (18.2)	44 (50.0)	28 (31.8)
Observation and participation in a delivery procedure	88	11 (12.5)	40 (45.5)	37 (42.0)
Cardiopulmonary resuscitation using automated external defibrillator	88	39 (44.3)	35 (39.8)	14 (15.9)
Special cardiopulmonary resuscitation (drug administration, defibrillation)	88	6(6.8)	40 (45.5)	42(47.7)
Dealing with foreign body airway obstruction	88	24 (27.3)	44 (50.0)	20 (22.7)
Pneumothorax drainage techniques	88	4(4.5)	29 (33.0)	55 (62.5)
Levin tube insertion	88	21 (23.9)	51 (57.9)	16 (18.2)
Observation of therapeutic procedures (abscess drainage)	85	42 (49.4)	36 (42.4)	7(8.2)
Management of diagnostic and therapeutic uncertainty and taking therapeutic decisions	88	26 (28.8)	52 (59.8)	11 (12.6)

Supplement Table 3. *Senior medical students self-reported competence in communication and infections control skills*

Procedure	N	I can n (%)	I can with help n (%)	I cannot n (%)
Professionalism (respect the autonomy of patients, respect patient' s medical confidentiality)	88	77 (87.5)	11 (12.5)	0 (0.0)
Communication skills with patients and relatives (bad news announcement, management of difficult patients or patients from different cultural background)	88	54(61.4)	32(36.3)	2(2.3)
Communication skills with other health professionals, working in a team	88	70(79.5)	16(18.2)	2(2.3)
Informing patients about modifiable risk factors (alcohol, smoking, nutrition. exercising) and screening tests (test Pap)	88	70(79.5)	17(19.4)	1(1.1)
Observation and presentation of imaging tests (x-ray, CT, MRI) to the patient	88	29(31.4)	54(62.8)	5(5.8)
Observation and presentation of intrusive diagnostic procedures to the patient	88	20(20.9)	43(50.0)	25(29.1)
Prescription of a medical recipe	88	51 (58.0)	34(38.6)	3 (3.4)
Documentation (discharge note, death certificate)	88	31(35.2)	50 (56.8)	7 (8.0)
Giving information about the procedure, obtaining and recording consent	88	46 (52.3)	40 (45.4)	2 (2.3)
Hand washing and use of personal protective equipment (gloves, gowns, masks)	88	78(88.6)	10(11.4)	0(0.0)
Safe disposal of clinical waste, needles and other 'sharps'	88	75 (85.2)	12 (13.7)	1 (1.1)

Supplement Table 4. *Senior medical students' self-reported competence in performing the 27 skills not taught in the "CSL"*

			Attended "CSL"				Not Attended "CSL"			
		N	I can n (%)	I can with help n (%)	I cannot n (%)	N	I can n (%)	I can with help n (%)	I cannot n (%)	Sig.
Diagnostic Procedures	Measuring and interpreting blood glucose	34	33 (97.1)	1 (2.9)	0 (0.0)	54	46 (85.2)	8 (14.8)	0 (0.0)	0.07
	Taking cultures (blood, urine, coating from pharynx, nose and skin) for testing	34	15 (44.1)	14 (41.2)	5 (14.7)	54	18 (33.3)	28 (51.9)	8 (14.8)	0.56
	Performing and interpreting a 12-lead electrocardiograph (ECG)	34	16 (47.1)	17 (50.0)	1 (2.9)	54	19 (35.2)	30 (55.5)	5 (9.3)	0.35
	Basic respiratory function tests	34	10 (29.4)	16 (47.1)	8 (23.5)	54	9 (16.7)	25 (46.3)	20 (37.0)	0.25
	Urine multidipstick test	34	28 (82.4)	6 (17.6)	0 (0.0)	54	34 (63.0)	18 (33.3)	2 (3.7)	0.12
	Pregnancy testing	34	16 (47.1)	5 (14.7)	13 (38.2)	54	23 (42.6)	17 (31.5)	14 (25.9)	0.18
	ABCDE assessment of a critically ill patient	34	17 (50.0)	16 (47.1)	1 (2.9)	54	27 (50.0)	24 (44.4)	3 (5.6)	0.84
	Interpretation of basic imaging tests (x-ray of chest/abdomen)	34	17 (50.0)	17 (50.0)	0 (00.0)	54	20 (37.0)	34 (63.0)	0 (00.0)	0.16
	Health needs assessment and decision making	34	12 (35.3)	18 (52.9)	4 (11.8)	54	13 (24.0)	34 (63.0)	7 (13.0)	0.52

			Attended "CSL"				Not Attended "CSL"			
		N	I can n (%)	I can with help n (%)	I cannot n (%)	N	I can n (%)	I can with help n (%)	I cannot n (%)	Sig.
Therapeutic Procedures	Blood Transfusion	34	2 (5.9)	10 (29.4)	22 (64.7)	54	1 (1.9)	13 (24.1)	40 (74.0)	0.48
	Wound care and basic wound dressing	34	26 (76.5)	8 (23.5)	0 (0.0)	54	48 (88.9)	6 (11.1)	0 (0.0)	0.11
	Correct techniques for 'moving and handling' patients	34	10 (29.4)	13 (38.3)	11 (39.3)	54	6 (11.1)	31 (57.4)	17 (31.5)	0.07
	Observation and participation in a delivery procedure	34	5 (14.7)	15 (44.1)	14 (41.2)	54	6 (11.1)	25 (46.3)	23 (42.6)	0.88
	Cardiopulmonary resuscitation using automated external defibrillator	34	18 (52.9)	13 (38.3)	3 (8.8)	54	21 (38.9)	22 (40.7)	11 (20.4)	0.26
	Special cardiopulmonary resuscitation (drug administration. defibrillation)	34	3 (8.9)	18 (52.9)	13 (38.2)	54	3 (5.6)	22 (40.7)	29 (53.7)	0.36
	Dealing with foreign body airway obstruction	34	13 (38.2)	14 (41.2)	7 (20.6)	54	11 (20.4)	30 (55.6)	13 (24.0)	0.18
	Pneumothorax drainage techniques	34	2 (5.9)	13 (38.2)	19 (55.9)	54	2 (3.7)	16 (29.6)	36 (66.7)	0.58
	Levin tube insertion	34	13 (38.2)	15 (44.2)	6 (17.6)	54	8 (14.8)	36 (66.7)	10 (18.5)	0.04
	Observation of therapeutic procedures (abscess drainage)	34	16 (47.1)	14 (41.1)	4 (11.8)	54	29 (53.7)	22 (40.7)	3 (5.6)	0.55
	Management of diagnostic and therapeutic uncertainty and taking therapeutic decisions	34	19 (55.9)	14 (41.2)	1 (2.9)	54	36 (66.7)	18 (33.3)	0 (0.0)	0.31
General & Communication procedures	Communication skills with other health professionals, working in a team	34	25 (73.5)	7 (20.6)	2 (5.9)	54	45 (83.3)	9 (16.7)	0 (0.0)	0.17
	Informing patients about modifiable risk factors (alcohol, smoking, nutrition. exercising) and screening tests (test Pap)	34	27 (79.4)	6 (17.7)	1 (2.9)	54	43 (79.6)	11 (20.4)	0 (0.0)	0.43
	Observation and presentation of imaging tests (x-ray, CT, MRI) to the patient	34	11 (32.3)	21 (61.8)	2 (5.9)	54	18 (33.3)	33 (61.1)	3 (5.6)	0.99
	Observation and presentation of intrusive diagnostic procedures to the patient	34	10 (29.4)	17 (50.0)	7 (20.6)	54	10 (18.5)	26 (48.2)	18 (33.3)	0.32
	Prescription of a medical recipe	34	24 (70.6)	10 (29.4)	0 (0.0)	54	27 (50.0)	24 (44.4)	3 (5.6)	0.10
	Documentation (discharge note, death certificate)	34	15 (41.1)	17 (50.0)	2 (5.9)	54	16 (29.6)	33 (61.1)	5 (9.3)	0.37
	Giving information about the procedure, obtaining and recording consent	34	19 (55.9)	14 (41.2)	1 (2.9)	54	27 (50.0)	26 (48.1)	1 (1.9)	0.79