

Surgical Training of Undergraduate Students at Mosul College of Medicine: A Preliminary Evaluation

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(Ann Coll Med Mosul 2021; 43 (2):115-122).

Received: 5th June 2021; Accepted: 31th August 2021.

ABSTRACT

Background: There is an idea that the level of medical college graduates is less than the expected. The improvement of medical training level for the undergraduates in medical schools need a re-evaluation and improvement for creation of new training programs including a better surgical training.

Objective: Is to evaluate the clinical surgical training of undergraduates at College of Medicine , University of Mosul .

Participants and methods: The study carried out at College of Medicine , University of Mosul during the year 2019. The study depends on questionnaire directed to 46 final year students who recently finished their clinical surgical training, 53 resident doctors graduated from the same college working among surgical wards, and 50 surgical department teachers and expert surgeons interested in medical education. The questionnaire asked about : does the student gain sufficient knowledge and clinical surgical skills during training, does the training provide safe doctor in work, does the training provide proper communication skills and ability to work properly in teams, and does the graduate able to gain the confidence of patients and other health workers. The participants score freely their answer in grade extend from 1-10, and asked to add any other notes up on surgical training of students including deleting or adding or any other suggestion.

Results: Knowledge gaining mean score by medical students, resident doctors, and expert surgeons was 6.9 ± 1.45 , 6.68 ± 1.82 & 6.68 ± 1.95 respectively, while mean score for providing safe doctor to community was 6.04 ± 1.39 , 6.52 ± 1.40 & 6.17 ± 1.17 respectively. On the other hand the mean score gaining regarding communication skills and ability to work in teams was 6.30 ± 1.44 , 6.37 ± 1.41 & 6.59 ± 1.13 respectively, while gaining the confidence of patients and other health workers mean score was 6.47 ± 1.18 , 6.74 ± 1.45 and 6.66 ± 0.99 respectively. In all , there was no significant differences. The clinical surgical skills gaining mean score by medical students , resident doctors and expert surgeons was 6.26 ± 1.61 , 4.92 ± 1.70 , and 5.8 ± 1.84 respectively. Which reflect the presence of a significant differences between resident doctors in comparison to students and expert surgeons.

Conclusion: There is lower mean score in gaining clinical surgical skills of graduates and there is a need for more clinical training, improvement, development of clinical training, and a re-evaluation of clinical training to improve the quality of medical teaching to get competent graduates.

Keywords: surgical training, evaluation, undergraduate students, medical school, knowledge, clinical skills.

التدريب الجراحي لطلاب البكالوريوس في كلية طب الموصل: تقييم أولي

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الخلاصة

خلفية الدراسة : هناك فكرة بأن مستوى خريجي كلية الطب هو أقل من المتوقع. إن تحسين مستوى تدريب طلبة كليات الطب يحتاج الى اعادة تقييم وتطوير لغرض خلق برامج تدريبية جديدة من ضمنها التدريب الجراحي.
هدف الدراسة: هو تقييم التدريب الجراحي السريري لطلبة كلية الطب جامعة الموصل.

عينة وطرق الدراسة : أجريت الدراسة في كلية الطب/ جامعة الموصل خلال العام ٢٠١٩ . تم اعتماد اداة جمع البيانات وجهت الى ٤٦ طالب من الصف المنتهي والذين أنهوا حديثا تدريبهم الجراحي ، كذلك ٥٣ طبيب مقيم متخرج من نفس الكلية ويعملون في الردهات الجراحية ، اضافة الى ٥٠ جراح اختصاصي او تدريسي وله اهتمام بالتعليم الطبي. اداة جمع البيانات تناولت أسئلة حول هل الطالب اكتسب القدر الكافي من المعرفة والمهارات الجراحية السريرية خلال التدريب ، هل التدريب اكسب الطالب المهارة الكافية لان يكون طبيب أمين في عمله ، هل التدريب اكسب الطالب بالمهارات المناسبة للتواصل والتفاهم والعمل بروح الفريق ، وهل تمكن الخريج من اكتساب ثقة المريض والعمال الصحيين . كانت درجات التقييم الحر للمشاركين تتراوح من (١ الى ١٠) وقد سمح للمشاركين بكتابة ملاحظاتهم حول التدريب الجراحي للطلبة وتقديم أي اقتراح.

نتائج الدراسة : كان معدل درجات اكتساب المعرفة ٦.٩ ، ٦.٦٨ ، ٦.٦٨ بالنسبة للطلبة والاطباء المقيمين والأخصائيين خبراء الجراحة على التوالي. في حين كان معدل درجات اكتساب صفات الطبيب الامن للمجتمع هو ٦.٠٤ ، ٦.٥٢ ، ٦.١٧ لنفس المجموعات أنفة الذكر. من ناحية اخرى كان معدل الدرجات لمهارات التفاهم والتواصل والقدرة على العمل كفريق هي ٦.٣ ، ٦.٣٧ ، ٦.٥٩ على التوالي بالنسبة للمجموعات المذكورة اعلاه. في حين كانت درجات تقييم اكتساب ثقة المرضى والزلاء من الكوادر الصحية ٦.٤٧ ، ٦.٧٤ ، ٦.٢٢ على التوالي لنفس المجموعات المذكورة اعلاه حيث لم يكن هناك اختلاف ذا اهمية احصائية. ان معدل درجات اكتساب المهارات الجراحية للطلبة والاطباء المقيمين وخبراء الجراحة من الاختصاصين كان ٦.٢٦ ، ٤.٩٢ ، ٥.٨ على التوالي مما يعكس وجود اختلاف ذا اهمية بين الاطباء المقيمين بالمقارنة مع اختصاصيي الجراحة والطلبة.

مجملة النتائج : هناك معدلات متدنية في اكتساب المهارات الجراحية السريرية للخريجين وهناك حاجة ملحة لتدريب سريري اكثر وتطوير وتحسين التدريب السريري وكذلك لإعادة تقييم التدريب السريري لغرض تحسين مستوى التعليم الطبي لنحصل على خريج كفوء.

الكلمات المفتاحية : التدريب الجراحي ، تقييم ، الطلبة غير المتخرجين / كلية الطب ، المعرفة ، المهارات السريرية .

INTRODUCTION

The training program in medical school should be directed to provide competent graduate that serve the needs of local community. There is a continuous need to determine the level of clinical training for medical students. There was wide satisfaction that the graduate not prepared well for daily tasks in hospitals and their surgical skill are below the acceptable level^{1,2}. The aim of the undergraduate surgical training is to prepare trainees to enter the clinical practice in rapid safe way³.

Surgical training of undergraduate medical students in basic clinical skills is an important part of their studies¹. Surgical skills training is a hard job, it needs large number of efficient surgical teachers, enthusiastic student, scientific media of teaching and efficient programme of teaching and repeated evaluation and development⁴. Medical students, surgical training differs in the various countries. Self-evaluation of surgical training by medical students can be applied¹.

Clinical training including surgical training in Iraq suffered from regression caused by many factors. There are few scientific reports on clinical training in our community⁵. The aim of this study is to evaluate the level of clinical surgical training carried out at College of Medicine, University of Mosul.

PARTICIPANTS AND METHODS

The study carried out at the College of Medicine, University of Mosul at period between April - November 2019. The study approved by research ethics committee at College of Medicine. College of Medicine, University of Mosul is the oldest college in North of Iraq, it is established at 1959. The teaching in the College is six years, the first 3 years mainly basic and fourth to sixth years are clinical teaching. Mosul is the second city in North of Iraq, it was occupied by ISIS at 10 June 2014, and subjected to wide destruction by occupation and military activities until its complete liberation at 8 December 2017.

The study depends on questionnaire designed to ask the participant on , is the graduate gain sufficient knowledge in surgery?, is the graduate gain sufficient surgical skill during their training ?, is the training provide safe doctor in work?, is the graduate gain sufficient skill of communications and ability to work in teams ?, and is the graduate gain the confidence of patients and other health workers?. Before the questionnaire was administered, its purpose was explained to participants and their individual permission secured. Names of the participants were not recorded. The participant asked to answer in grade, the grade scale extend form 0-10 and the participant mark the grade freely. The questionnaires' also asked to comment on any suggestion to correct program of surgical training by deleting some part of program, or adding more

clinical training , or to improve and develop the clinical training and adding more subjects.

The Questionnaire given to three groups, the first group is the 6th year students who complete their surgical training, 70 questionnaire forms send to students , 46 complete the questionnaire (response rate is 66 %) . The second group was the recently graduated doctors who are graduated from Mosul College of Medicine and are working as surgical ward resident doctors , 70 questionnaire forms sent to resident doctors , only 53 resident doctor complete the questionnaire (with response rate of 75 %) . The third group was the expert surgeons and surgical teachers involved in surgical teaching and training, who are working in surgical wards and who are sharing in undergraduate and postgraduate clinical training . Seventy questionnaire forms sent to expert surgeons , only 50 surgeons complete the questionnaire (with a response rate of 71.4 %) . The data collected and analyzed. Statistical analysis carried out by Excel for Office 365, the mean and standard deviation calculated . Data were imported into SPSS 24 (Version 24.0. Armonk, NY: IBM Corp.) for inferential analysis. Multivariant ANOVA used in comparing the groups, and Duncan test used also.

RESULTS

The final year medical school students share in this study were 46 (27 females and 19 males) , their mean age was 23.97 ± 0.77 . The resident doctors in surgical wards who had been graduated from the same college were 53 (28 females and 25 males) , their mean age was 26.59 ± 1.84 . The expert surgeons and surgical teachers who share in this study were 50 (3females and 47males) , and their mean age was 47.12 ± 9.2 (table 1).

The mean knowledge gaining score by students is 6.9 ± 1.45 , by resident doctors is 6.68 ± 1.82 , and by expert surgeons is 6.68 ± 1.95 (table 1). Using paired t-test, ANOVA and Duncan test, there was no significant differences (table 2). .The mean surgical skills gaining score by students is 6.26 ± 1.61 , by resident doctors is 4.92 ± 1.70 , and by expert surgeons is 5.8 ± 1.8 . Using paired t-test, ANOVA and Duncan test, there was statistically significant differences between resident doctors and students and expert surgeons (table 3).Providing safe doctor to community mean score by students is 6.04 ± 1.39 , by resident doctors is 6.52 ± 1.40 , and by expert surgeons is 6.17 ± 1.17 . Again by using paired t-test, ANOVA and Duncan test, there was no significant differences (table 4). Skills of communication and ability to work in teams mean score by students is 6.30 ± 1.44 , by resident doctors is 6.37 ± 1.41 , and by

expert surgeon is 6.59 ± 1.13 . By using paired t-test, ANOVA and Duncan test, there was statistically non- significant differences (table 5). Gaining the confidence of patients and other health workers mean score by students is 6.47 ± 1.1 , by resident doctors is 6.74 ± 1.45 , and by expert surgeons is 6.66 ± 0.99 . By using paired t-test, ANOVA and Duncan test, there was no statistically significant differences (table 6).

Sixteen of students, 14 of resident doctors, and 6 of expert surgeons suggest to remove some of details and rare diseases. The suggestion of adding more clinical training and more training in emergency accepted by 16 students, 32 resident doctors and 20 expert surgeons. The suggestion of improvement and development of surgical training accepted by 11 students, 26 resident doctors and 22 expert surgeons.

Table-1- The demographic characteristics and mean score of surgical training by participants.

Demographic and surgical training parameter		Medical students	Resident doctors	Expert surgeons
Number of participants		46	53	50
Gender	Male	19	25	42
	Female	27	26	3
Mean age		23.97 ± 0.77	26.59 ± 1.84	47.12 ± 9.2
Knowledge gaining mean score		6.9 ± 1.45	6.68 ± 1.82	6.68 ± 1.95
Surgical skills gaining mean score		6.26 ± 1.61	4.92 ± 1.70	5.8 ± 1.84
providing safe doctor mean score		6.04 ± 1.39	6.52 ± 1.40	6.17 ± 1.17
communications skills and ability to work in teams mean score		6.30 ± 1.44	6.37 ± 1.41	6.59 ± 1.13
gaining the confidence of patients and other health workers mean score		6.47 ± 1.18	6.74 ± 1.45	6.66 ± 0.99

Table -2. Paired t-test, ANOVA and Duncan test for knowledge gaining score assessment

Paired t- Test									
	Paired Differences					t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1 m* - t**	.04348	2.04349	.30130	-.56336-	.65032	.144	45	.886	
Pair 2 m - ho***	.28261	2.06196	.30402	-.32972-	.89494	.930	45	.358	
Pair 3 t - ho	.06000	1.82287	.25779	-.45805-	.57805	.233	49	.817	

* Medical students
 ** expert surgeons
 *** house officer doctors

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	1.930	2	.965	.489	.614
Within Groups	288.311	146	1.975		
Total	290.242	148			

Duncan test			
	VAR00003	N	Subset for alpha = 0.05
			1
Duncan ^{a,b}	Ho	53	6.6604
	T	50	6.7400
	M	46	6.9348
	Sig.		.364

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 49.499.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table -3. Paired t-test, ANOVA and Duncan test of assessment results for surgical skills gaining score.

Paired Samples Test									
	Paired Differences					T	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1 m - t	.36957	2.31285	.34101	-.31727-	1.05640	1.084	45	.284	
Pair 2 t - ho	.96000	2.79913	.39586	.16450	1.75550	2.425	49	.019	
Pair 3 ho - m	-1.32609-	2.55651	.37694	-2.08528-	-.56690-	-3.518-	45	.001	

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	47.265	2	23.632	8.363	.000
Within Groups	412.588	146	2.826		
Total	459.852	148			

Duncan test				
	VAR00003	N	Subset for alpha = 0.05	
			1	2
Duncan ^{a,b}	Ho	53	4.9245	
	T	50		5.8600
	M	46		6.2609
	Sig.		1.000	.237

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 49.499.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table -4. Paired t-test, ANOVA and Duncan test for assessment results regarding whether the training provide safe doctor in work .

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 m – t	.08696	1.95307	.28796	-.49303-	.66695	.302	45	.764
Pair 2 t – ho	-.30000-	1.78714	.25274	-.80790-	.20790	-1.187-	49	.241
Pair 3 ho - m	.30435	2.04254	.30116	-.30221-	.91091	1.011	45	.318

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.527	2	1.263	.657	.520
Within Groups	280.695	146	1.923		
Total	283.221	148			

Duncan test			
	VAR00003	N	Subset for alpha = 0.05
			1
Duncan ^{a,b}	T	50	6.2200
	M	46	6.2609
	Ho	53	6.5094
	Sig.		.332

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 49.499.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table -5. Statistical analysis for assessment score regarding sufficient gain of communication skills and ability to work in teams

Paired Samples Test								
	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 m – t	-.24444-	1.77297	.26430	-.77710-	.28822	-.925-	44	.360
Pair 2 t – ho	.26531	1.85714	.26531	-.26813-	.79874	1.000	48	.322
Pair 3 ho – m	.13043	2.01780	.29751	-.46878-	.72965	.438	45	.663

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.154	2	1.077	.605	.547
Within Groups	258.029	145	1.780		
Total	260.182	147			

Duncan test			
	VAR00003	N	Subset for alpha = 0.05
			1
Duncan ^{a,b}	M	46	6.3043
	Ho	53	6.3774
	T	49	6.5918
	Sig.		.318

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 49.168.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Table -6. Statistical analysis for assessment results regarding whether the graduate gain the confidence of patients and other health workers

Paired Samples Test								
	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 m – t	1.39130	10.75273	1.58540	-1.80186-	4.58447	.878	45	.385
Pair 2 t – ho	-.06000-	1.93158	.27317	-.60895-	.48895	-.220-	49	.827
Pair 3 ho – m	-1.17391-	10.37798	1.53015	-4.25579-	1.90797	-.767-	45	.447

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	55.669	2	27.834	.778	.461
Within Groups	5220.613	146	35.758		
Total	5276.282	148			

Duncan test			
	VAR00003	N	Subset for alpha = 0.05
			1
Duncan ^{a,b}	T	50	6.6800
	Ho	53	6.7170
	M	46	8.0217
	Sig.		.297

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 49.499.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

DISCUSSION

The assessment results revealed a relatively low mean scores for the gained knowledge regarding surgical capabilities of newly graduating doctors and their ability to practice team work and to communicate properly with health services consumers. Such result can be explained through the fact that Iraqi colleges of medicine are concentrating more on students' attendance and less on updating the curriculum which is outdated. Each medical college has its own curriculum, and there are no guidelines that apply to all medical schools. Learning is still traditional, and characterized by a teacher-centered approach. This method centers on the teacher who is controlling the course content and the methods of presentation i.e. focusing on teaching rather than learning^{5,6}. The modern style of medical education has at yet been introduced: the one which depends on a student-centered approach in which the students are encouraged to take greater responsibility for learning decisions and to question what and how they learn, while they are supervised by a mentor^{5,7}.

There is a worldwide continuous discussions and efforts to improve the clinical training of medical schools students including surgical training in last two decades¹. Medical students across the United

Kingdom report a diminished surgical training in hospitals and a lower satisfaction with surgical teaching⁸. Most students expressed uncertainty in clinical surgical skills¹. American medical students finding their clinical training programs inadequate⁹.

From other point of view, the assessment results revealed a statistically significant unacceptable low mean scores for the gained surgical skills of graduates. As the graduate start to work among surgical wards and casualty units, they feel an actual deficit on their clinical surgical skills and inability to do properly all essential skills and some lifesaving surgical maneuvers or procedures. Most students expressed uncertainty in clinical skills, such as performing a surgical suture or applying gypsum/bandage. Students feel unprepared for clinical every day work due to lacking training of basic practical skill within the frame work of their training¹.

Surgical training may fail to produce competent graduates². Medical students surgical training differs in the various countries.^{1,3}. In developing countries, the surgical training of undergraduate student shows significantly lower level in comparison with developed countries³. The surgical skills, technical knowledge, basic surgical knowledge, and surgical judgment among surgical trainees can be assessed¹⁰.

There is marked deterioration in medical services and medical teaching in Iraq in the last three decades caused by many factors. The 2003 USA and coalition invasion of Iraq accelerated a steady deterioration in medical services and medical training and graduates. Iraqi political problems had a marked effects on health fields. The 2014 invasion of Iraq by ISIS (Islamic State of Iraq and Syria) made the condition worse⁵. The level of surgical skill in graduates of our college was significantly low, this reported by resident doctors work in surgical wards, and it is lower than that reported by Westermann et al. The knowledge and clinical skills deficiency had been observed in the students of our college.^{5,6,11,12}

Medical colleges should revise, innovate and evaluate training programs carried out at their different departments to produce competent graduates meet the needs of their local community with changes in these programs including quantity, quality, efficiency, and mode of delivery. Outpatient and emergency department should be created in site of training, this can be applied when there is limited resources like our situation.. The network and social media can be used to improve the training and in follow-up of students. The network, social media, skill laboratories, intensive courses and computer facilities can improve the surgical training and this proved by many studies^{2,7,13-15}. Medical students should

gain sufficient essential knowledge , clinical skills and good communication skills to deal with patients and other health workers ^{6,16}.

This study is the first trial to evaluate surgical training in our region. We depended on self-evaluation of surgical training by final year medical school students, and recently graduated resident doctors work in surgical wards, this method usually used in clinical training evaluation even this questionnaire is not validated ^{1,3}. In our study experts surgeons involved in medical teaching share in study, they represent the stakeholders ¹⁴.

CONCLUSION & RECOMMENDATION

The study can conclude that there is relatively low level of surgical skill gaining among Mosul college graduates with low level in knowledge gaining, ability to communicate with patients and work as a team , provide safe doctor in work, gaining the confidence of patients and other health workers. There is a need for more clinical training, improvement and development of clinical training. The shortage of tertiary hospital can be compensated by using out patients, rural hospital or emergency department for teaching and creation of more outpatients and emergency room for teaching and to serve the community

REFERENCES

1. Westermann L, Zisimidou B, Simons M, Rene Zellweger R , Baschera D. Self-evaluation of present clinical skills by medical students in the years 3 to 6 – a pilot study in four European countries. *GMS J Med Educ.* 2018; 35(3): Doc36. Published online 2018 Aug 15. doi: 10.3205/zma001182.
2. Birch DW , Brian Mavis B. A needs assessment study of undergraduate surgical education. *Can J Surg.* 2006 Oct; 49(5): 335–340.
3. Scott A J, Drevin G, Pavlović L, Nilsson M, Krige J E J, Jonas E. Medical Student And Faculty Perceptions Of Undergraduate Surgical Training In The South African And Swedish Tertiary Institutions: A Cross-Sectional Survey. *Adv Med Educ Pract.* 2019; 10: 855–866.
4. Bennett SR, Morris SR, Mirza S. Medical Students Teaching Medical Students Surgical Skills: The Benefits of Peer-Assisted Learning. *J Surg Educ.* 2018 Nov;75(6):1471-1474.
5. Al-Shamsi M . Medical education in Iraq: issues and challenges. *Int J Med Educ.* 2017; 8: 88–90.
6. Al-Dabbagh S A, Al-Taee W G . Evaluation of a task-based community oriented teaching model in family medicine for undergraduate medical students in Iraq. *BMC Medical Education.* 2005; 5: 31 - 39.
7. Bruening M H , Maddern G J . Surgical Undergraduate Education in Rural Australia. *Arch Surg.* 2002;137(7):794-798.
8. Hakim M A, Dominguez E D, Priest S, Lee K S, Mjardanpour A, Tandle S . Surgical Skills Workshops Should Be a Part of the United Kingdom Undergraduate Medical Curriculum. *Cureus.* 2019 May;11(5): e4642.
9. Tardif A G, Laporte G B, Khwaja K, Ntakiyiruta G, Kyamanywa P, Razek T, Deckelbaum et al. Enhancing medical students' education and careers in global surgery. *Can J Surg.* 2014 Aug; 57(4): 224–225.
10. Balayla J, Bergman S, Ghitulescu G, Feldman L S, Fraser S A. Can J Surg. Knowing the operative game plan: a novel tool for the assessment of surgical procedural knowledge. 2012 Aug; 55(4 Suppl 2): S158–S162.
11. Nordquist J, Sundberg K, Johansson L, Sandelin K, Nordenström J. Case-based learning in surgery: lessons learned. *World J Surg.* 2012 May;36(5):945-55.
12. Lafta R, Al-Ani W, Dhiaa S , Cherewick M, Hagopian A , Burnham G. Perceptions, experiences and expectations of Iraqi medical students. *BMC Medical Education,* 2018; 18: 53 – 60.
13. Alexander EK. Perspective: moving students beyond an organ-based approach when teaching medical interviewing and physical examination skills. *Acad Med.* 2008;83(10):906–909.
14. Li J Z, Chan S C Y, Au M, Hoogenes J, Chan T, Li K, Reid S. Review of a medical student–run surgery lecture series and skills lab curriculum. *Can J Surg.* 2014 Jun; 57(3): 152–154.
15. Härtl A, Berberat P, Fischer M R, Forst H, Grützner S, Händl T et al. Development of the competency-based medical curriculum for the new Augsburg University Medical School. *J Med Educ.* 2017; 34(2): Published online 2017 May 15. doi: 10.3205/zma001098.
16. Gómez S S , Ostos E M C, Solano J M M , Salado T F H. An electronic portfolio for quantitative assessment of surgical skills in undergraduate medical education. *Medical Education* 2013; 13:65. <https://doi.org/10.1186/1472-6920-13-65>.