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Research Paper

The self-assessment of newly graduated orthopedic surgeons on essential surgical procedures

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ABSTRACT

Objective: The aim of this study was to assess the self-confidence of newly graduated orthopedic surgeons on performing essential surgical procedures.

Methods: The study included 151 orthopedics and traumatology surgeons who had completed their (orthopedics and traumatology) training within the last year. They were asked to complete an online questionnaire which was available from February 2020 to May 2021. In the questionnaire, newly graduated orthopedic surgeons were asked whether they could do the 18 listed essential adult and 8 listed essential pediatric cases independently. They were asked about patient follow-up systems and who these were supervised by, the demographic data of the city and about the institution they were trained in, and how many times they performed the listed surgeries during their training.

Results: 74 (49%) of the participants received their training in training and research hospitals, 69 (45.7%) in state university hospitals, and 8 (5.3%) in foundation university hospitals. More than 80% of the participants answered, "I can do it independently" for 13 (81.6%) out of 16 adult cases and 7 (87.5%) out of 8 paediatric cases. The average self-efficacy score of the participants was 32.22 out of 36 for adult cases and 15.3 out of 16 for paediatric cases. The total average self-efficacy score was 47.52 out of 52.

Conclusion: This study has shown us that newly graduated orthopedic surgeons have the self-confidence to handle many of the essential types of cases independently.

Introduction

The case distribution that each orthopedic surgeon will encounter throughout their professional life may differ. However, all orthopedic surgeons should have essential skills to improve their learning curve. In order to monitor the sufficiency of training, it is necessary to determine the minimum standards and then carry out the surveillance.

Orthopedics and traumatology residency training in Turkey is a 5-year program under the auspices of a core curriculum of the Medical Speciality Board.[1] According to the board, orthopedics and traumatology training aims to make residents competent in diagnosing and treating musculoskeletal diseases and making them good practitioners in terms of medical ethics.[1] In this respect, it is crucial to train the surgeons to be competent on essential orthopedic interventional procedures independently and to be able to run an orthopedic clinic by themselves.[2] In the United States, digital registration is required for all surgical procedures performed by residents in the operation and emergency room. In addition, the minimum number of orthopedic interventions for the qualification of residents' essentials have also been set since 2013.[3] In Turkey, individual resident report cards are issued separately for residents by each university and institution. All stages of the training process and operations related to basic skills are recorded in these cards. However, Turkey does not have a central registry system or a defined minimum number of cases for graduation. In some institutions, records are not kept regularly and are not audited.

Residency training is given in different institutions. No study in the literature covers how competently residents can perform essential orthopedic interventions in institutions or the levels of self-confidence they feel after graduation. This study examines the self-confidence of newly graduated orthopedic surgeons on the basis of essential surgical procedures in a sample where a central system does not track case records. Moreover, this study aims to examine the minimum number of interventions needed to achieve self-confidence.

Materials and Methods

This study was approved by the Ankara City Hospital Ethics Committee with the number E1-20-311. A web-based cross-sectional survey was performed 3 times

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between February 2020 and May 2021 via e-mail and social media, with a reminder every month. The survey was designed using surveymonkey.com, a web-based survey system. The study included volunteer orthopedics and traumatology surgeons who had completed orthopedics and traumatology training within the last year. Participants who did not complete the survey were excluded from the study as they were surgeons with more than 1 year of experience in orthopedics and traumatology.

The survey was based on 7 sections: [1] questions about the type of institution where the participants received their orthopedics and traumatology training (university/training and research hospital), [2] the kind of city in which they received training (we stratified the cities where education was obtained according to their population [class I cities ≥4 000 000, class II cities 4 000 000-1 000 000\class III cities ≤1 000 000]), [3] how much time has passed since the end of orthopedic education, [4] the existence of a local system for the follow-up of the cases in which the residents were involved in the clinics, and, [5] if applicable, questions about who supervised that system were asked. [6] Eighteen adult and 8 pediatric orthopedic interventions, determined as interventions that needed to be performed independently by an orthopedics traumatology surgeon, were evaluated in surveys conducted with program managers and orthopedic surgeons.[2,4] [7] And finally, the participants were asked questions regarding their self-confidence at graduation in adult and pediatric orthopedic surgical procedures on 26 case types. Self-confidence levels were specified as "I cannot do it independently" (0 points), "I can do it under the supervision of a more senior surgeon" (1 point), or "I can do it independently" (2 points). According to these ratings, a minimum of 0 and maximum of 36 points for the 18 adult cases and a minimum of 0 and maximum of 16 points for the 8 pediatric cases could be attained. In total, self-confidence scores were calculated within a range of 0-52 points.

The number of cases in which the resident surgeons were involved was specified in ranges as 0-5 (1 point), 6-10 (2 points), 11-15 (3 points), 16-30 (4 points), or more than 30 (5 points). The scores for the cases in which the residents operated were calculated according to the established point system; a minimum of 18 and a maximum of 90 for the 18 adult cases, a minimum of 8 and a maximum of 40 for the 8 pediatric cases, respectively. In total, case scores were calculated within a range of 26-130 points.

Statistical analysis

Statistical analysis was performed using International Business Machines Statistical Package for the Social Sciences software 22.0 for Windows (IBM SPSS Corp., Armonk, NY, USA). Descriptive statistics for numerical variables were expressed as mean, standard deviation, median, minimum, and maximum values. Due to the small number of groups, non-parametric test procedures were used. In this context, Kruskal–Wallis analysis of variance and Dunn's tests were performed to determine the relationships between parameters. Receiver operating characteristic curve analysis was performed to determine cut-off values. The results were evaluated within 95% CI, and $P < 0.05$ was considered significant.

HIGHLIGHTS

- There are essential skills that all orthopedic surgeons must master for improving their learning curve. However,Turkey does not have a central registry system or a defined minimum number of interventions for basic surgical skills for orthopedic surgery residents.
- More than 80% of the participants answered "I can do it independently" for 13 out of 16 adult cases and 7 out of 8 pediatric cases. The lowest rates of "I can do it independently" responses were obtained for spinal decompression posterior vertebral arthrodesis (11.9%) and ankle, subtalar, and midfoot arthrodesis (55%) among adult cases whereas the rates were slipped capital femoral epiphysis closed pinning (76.8%) and arthroscopic knee debridement (85.4%) for pediatric cases.
- Orthopedics and traumatology specialization training should aim to provide personal and professional development for individuals so that they can, in turn, provide safe and appropriate health services. Program directors should ensure that the graduated surgeons acquire the experience to independently apply the current techniques while maintaining a high standard of care for the patients. This may be aided by setting up a centralized system to track the cases attended by residents during their training.

Results

Between February 2019 and May 2021, 291 orthopedics and traumatology residents completed their training and became surgeons in Turkey. During this research, 157 orthopedics and traumatology surgeons participated in the survey. As 6 (3.8%) participants did not fully complete the survey questions, they were excluded from the study. A total of 151 surveys were included. It was seen that 74 (49%) of the participants received their training in training and research hospitals, 69 (45.7%) in public university hospitals, and 8 (5.3%) in foundation university hospitals. The city of the institution where the participants received training was found to be class I cities for 100 participants (66.2%), class II cities for 30 participants (19.9%), and class III cities for 21 (13.9%) participants. Case records of 83 (55%) of the participants were not followed. The records of 40 (26.5%) were tracked by the program manager, 9 (6%) by another trainer in their clinics, and 19 (12.6%) by the residents themselves of participants.

More than 80% of the participants answered "I can do it independently" for 13 (81.6%) out of 16 adult cases and 7 (87.5%) out of 8 pediatric cases. The lowest rates of "I can do it independently" responses were obtained for spinal decompression/posterior vertebral arthrodesis (11.9%) and ankle, subtalar, and midfoot arthrodesis (55%) among adult cases. In contrast, the lowest rates for this answer were found for slipped capital femoral epiphysis closed pinning (76.8%) and arthroscopic knee debridement (85.4%) among pediatric cases (Table 2).

The average self-confidence score of the participants was 32.22 for adult cases and 15.3 for pediatric cases. The total average self-confidence score was 47.52. Self-confidence scores according to institution types are provided in detail in Table 2. There was no statistically significant difference in self-confidence scores among institution types ($P \geq 0.05$). There was a significant relationship between adult, pediatric, and total self-confidence scores and the follow-up of cases with intervention by residents in the clinics ($P=0.007$, $P=0.009$, and $P=0.001$, respectively).

The mean score for the number of adult cases of the participating orthopedic surgeons was 55.22 and the mean score for pediatric cases

Table 1. Participants' demographics

Type of training clinic n (%)	**Training and research 74 (49%)**	**Public university 69 (45.7%)**	**Foundation university 8 (5.3%)**
Type of city n (%)	Class I 100 (66.2%)	Class II 30 (19.9%)	Class III 21 (13.9%)
Local case registry system n (%)	Tracked 68 (45%)		Not tracked 83 (55%)
	By training supervisor 40 (26%)	By another trainer 9 (%)	By residents 19 (12.6%)

Table 2 Distribution of survey answers

Case	Self-confidence			Number of cases					
	Cannot do it 0 points	Can do it under the supervision of a more senior surgeon 1 point	Can do it independently 2 points	0-5 1 Point	6-10 2 Points	11-15 3 Points	16-30 4 Points	>30 5 Points	Cut-off Range
Adult									
Implant removal	0	0	151 (100%)	0	6 (4%)	17 (11.3%)	35 (23.2%)	93 (61.6%)	-
Uniplanar external fixator	0	4 (2.7%)	147 (97.3%)	22 (14.6%)	40 (26.5%)	24 (15.9%)	28 (18.5%)	37 (24.5%)	0-5 to 6-10
Bimalleolar fracture-ORIF	0	0	151 (100%)	5 (3.3%)	13 (8.6%)	33 (21.9%)	41 (27.2%)	59 (39.1%)	-
Open fracture irrigation and debridement	0	0	151 (100%)	5 (3.3%)	12 (7.9%)	29 (19.2%)	32 (21.2%)	73 (48.3%)	-
Femoral shaft fracture-IMN	0	4 (2.7%)	147 (97.3%)	15 (9.9%)	32 (21.2%)	40 (26.5%)	25 (16.6%)	39 (25.8%)	0-5 to 6-10
Tibia shaft fracture-IMN	0	2 (1.4%)	149 (98.6%)	15 (9.9%)	36 (23.8%)	38 (25.2%)	21 (13.9%)	41 (27.2%)	0-5 to 6-10
Intertrochanteric, pertrochanteric, subtrochanteric femur-IMN	0	7 (4.6%)	144 (95.4%)	10 (6.6%)	22 (14.6%)	24 (15.9%)	27 (17.9%)	68 (45%)	5-10 to 11-15
Carpal tunnel release	0	3 (2%)	148 (98%)	13 (8.6%)	25 (16.6%)	41 (27.2%)	30 (19.9%)	42 (27.8%)	0-5 to 6-10
Trigger finger release	0	0	151 (100%)	16 (10.6%)	14 (9.3%)	35 (23.2%)	36 (23.8%)	50 (33.1%)	-
Arthroscopic meniscectomy	0	11 (7.3%)	140 (92.7%)	30 (19.9%)	33 (21.9%)	27 (17.9%)	12 (7.9%)	49 (32.5%)	5-10 to 11-15
Femoral neck fracture hemiarthroplasty	0	8 (5.3%)	143 (94.7%)	13 (8.6%)	16 (10.6%)	29 (19.2%)	30 (19.9%)	63 (41.7%)	11-15 to 16-30
Arthroscopic subacromial decompression	30 (20%)	32 (21.1%)	89 (58.9%)	95 (62.9%)	17 (11.3%)	18 (11.9%)	7 (4.6%)	14 (9.3%)	0-5 to 6-10
Total knee arthroplasty	0	11 (7.3%)	140 (92.7%)	19 (12.6%)	16 (10.6%)	30 (19.9%)	18 (11.9%)	68 (45%)	0-5 6-10
Intra-articular distal radius fracture-ORIF	0	15 (10%)	136 (90%)	26 (17.2%)	42 (27.8%)	28 (18.5%)	26 (17.2%)	29 (19.2%)	0-5 to 6-10
Total hip arthroplasty	4 (2.7%)	29 (19.2%)	118 (78.1%)	61 (40.4%)	23 (15.2%)	29 (19.2%)	23 (15.2%)	15 (9.9%)	0-5 to 6-10
Arthroscopic ACL reconstruction	16 (10.6%)	35 (23.2%)	100 (66.2%)	89 (58.9%)	30 (19.9%)	7 (4.6%)	10 (6.6%)	15 (9.9%)	0-5 to 6-10
Ankle, subtalar, and midfoot arthrodesis	21 (13.9%)	47 (31.1%)	83 (55%)	115 (76.2%)	17 (11.3%)	7 (4.6%)	7 (4.6%)	5 (3.3%)	0-5 to 6-10
Spinal decompression/posterior vertebral arthrodesis	88 (58.2%)	45 (29.8%)	18 (11.9%)	117 (77.5%)	22 (14.6%)	9 (6%)	3 (2%)	0	0-5 to 6-10
Pediatric									
Implant removal	0	2 (1.4%)	149 (98.6%)	18 (11.9%)	42 (27.8%)	27 (17.9%)	19 (12.6%)	45 (29.8%)	-
Lateral malleolar fracture fixation	0	2 (1.4%)	149 (98.6%)	53 (35.1%)	39 (25.8%)	25 (16.6%)	11 (7.3%)	23 (15.2%)	-
Open fracture irrigation and debridement	0	2 (1.4%)	149 (98.6%)	33 (21.9%)	43 (28.5%)	35 (23.2%)	18 (11.9%)	22 (14.6%)	-
Arthroscopic knee debridement	14 (9.3%)	8 (5.3%)	129 (85.4%)	93 (61.6%)	32 (21.2%)	11 (7.3%)	12 (7.9%)	3 (2%)	0-5 to 6-10
Percutaneous fixation of the supracondylar humerus	0	7 (4.6%)	144 (95.4%)	12 (7.9%)	28 (18.5%)	26 (17.2%)	28 (18.5%)	57 (37.7%)	11-15 to 16-30
Percutaneous fixation of distal radius	0	4 (2.7%)	147 (97.3%)	17 (11.3%)	37 (24.5%)	22 (14.6%)	35 (23.2%)	40 (26.5%)	-
Radius and ulnar shaft fractures-ARIF	0	6 (4%)	145 (96%)	22 (14.6%)	46 (30.5%)	26 (17.2%)	27 (17.9%)	30 (19.9%)	-
Slipped capital femoral epiphysis closed pinning	12 (8%)	23 (15.2%)	116 (76.8%)	118 (78.1%)	24 (15.9%)	5 (3.3%)	3 (2%)	1 (0.7%)	0-5 to 6-10

was 21.17, making the total average score 76.38. There was a significant relationship between scores of adult, pediatric, and the total number of cases and the follow-up status of these cases ($P=0.001$, $P < 0.001$, and $P < 0.001$, respectively). There was also a significant relationship between adult, pediatric, and total case number scores and the follow-up of cases with intervention by residents in the clinics ($P=0.007$, $P=0.009$, and $P=0.001$, respectively).

For calculable cases, cut-off values were determined for the answer of "I can do it independently." Some cut-off values could not be calculated since all participants answered "I can do it independently" for cases 1, 3, 4, and 9 among the adult cases, respectively. The calculated cut-off values for the relevant cases are presented in Table 2. For pediatric cases, only the cut-off values of cases 4, 5, and 8 could be calculated (Table 2).

Discussion

In this study, the numbers of essential cases operated by the residents until graduation and their self-confidence to those cases at the end of training were evaluated in the context of a core training system that does not have a central case tracking system. The study data showed that many graduated surgeons felt competent in operating essential cases independently without any evidence of criteria.

According to the results of this study, more than 80% of the participating surgeons said that they could operate independently for 81.6% of the specified adult cases and 87.5% of the pediatric cases. In a study conducted in the United States, where cases were tracked with a central registration system, graduate surgeons answered, "I can do it independently" for 77% of adult cases and 87.5% of pediatric cases.[2] The self-confidence data of the present study are compatible with the literature. It is crucial for a well-trained orthopedic surgeon to feel competent to apply techniques while working independently after graduation successfully.

Cases in which fewer than 80% of the participants could reply "I can do it independently" were spinal decompression/posterior vertebral arthrodesis (11.9%); ankle, subtalar, and midfoot arthrodesis (55%); arthroscopic subacromial decompression (58.9%); and slipped capital femoral epiphysis closed pinning (76.8%). Young orthopedists who have undergone orthopedic surgery training in Turkey do not consider themselves sufficient in these subjects, and they participate in fewer cases than the calculated cut-off values. There may be a lack of exposure in some fields in some institutions, and residents trained in those institutions should be given equal training opportunities with planned rotations. Training clinics and speciality boards should design programs and plans to eliminate these shortcomings.

The rates obtained in this research were statistically similar among different institutions and city types. However, the self-confidence rate was seen to vary according to the tracking supervisor of the clinic. It was observed that self-confidence was significantly higher in clinics where the training supervisor recorded the number of cases. This situation was due to the surgeons' subjective self-evaluations. Orthopedics and traumatology specialization training aims to provide personal and professional development for individuals so that they can, in turn, provide safe and appropriate health services to their patients. Surgeons need to have a good command of current surgical techniques to provide holistic services independently. Program directors should ensure that the graduated surgeons can independently apply current techniques while also ensuring that the service provided to patients is of high quality.

Cut-off values were calculated for each case based on the answers of these newly graduated surgeons (Table 2). The cut-off values obtained in the study by Kohring et al[2] were much higher. While the cut-off value was 50.1 for total knee arthroplasty in the Kohring et al[2] study, it was found to be between 0-5 and 6-10 in our study. Similarly, it was 29.6 for intramedullary nailing of intertrochanteric fractures, while it was found to be between 6-10 and 11-15 in our study.[2] This difference suggests that residents in Turkey feel that they can handle certain cases independently while having intervened in a smaller number of cases. Such a significant difference shows that people's self-evaluations are very subjective. Therefore, it should be ensured that trainees are exposed to the required numbers of cases by forming a consortium regarding the number of cases that must be achieved for competence in essential cases while considering the opinions of trainers who are expert on the subject. This situation should be reviewed during training with a central system. For types of cases for which higher numbers are required for self-confidence, ways to help residents intervene in more cases should be explored.

Surgeons and educational institutions should discuss the self-confidence of newly graduated orthopedic surgeons observed in this study. The fact that newly graduated surgeons can gain self-confidence with few cases has caused the suspicion of over-confidence. It is expected that newly graduated surgeons will be more careful when diagnosing and treating complications that may arise. While self-confidence is an essential requirement for working alone, the young surgeons' awareness of the need for supervision may be more important than their surgical skills. There is also a need for studies that objectively evaluate and compare the subjective self-confidence of newly graduated surgeons by senior surgeons.

The Turkish Society of Orthopaedics and Traumatology has been conducting a board exam every year since 2003.[5] For case numbers to be determined for self-confidence, the minimum number of cases should be determined by a competent and independent team of trainers in orthopedics and traumatology and monitored daily with a central system. Thus, the essential practical training of orthopedics and traumatology residents across Turkey can be followed. It can be confirmed that the resident surgeons are operating the cases required for essential resident training in those institutions. Some countries require case reports showing the number of cases treated for equivalence applications. The institutions should determine the minimum number of cases required for specialization training and equivalence procedures. It should be ensured that surgeons with self-confidence in the field are trained.

There are some limitations of this study. Firstly, the participants answered in a way they remembered since the number of cases was not kept in some clinics. Since the records of most of the participants were not tracked regularly, the intervals of the participants could be questioned. Therefore, it was possible to search for cut-off intervals, not cut-off values. Finally, the collected data were retrospective. Prospective studies with more considerable participation rates should be planned and the specific cases treated by surgeons in the first years of their careers should be evaluated independently by senior trainer surgeons. In order to carry out more inclusive

studies, a central and supervised regular registration system should be established.

As a result of this study, it was observed that graduated orthopedic surgeons have the self-confidence to handle many essential types of cases independently. However, the low number of cases determining this self-confidence is a problem that requires further research. Considering that the examined cases were essential cases, local and central training planners must take steps to eliminate these shortcomings in each training clinic.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Ankara City Hospital (E1-20-311).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

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